Quality Assurance Manual

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ALS-Kelso SOP Procedural Change Form and Revision Request

SOP Code: QAM_Kelso
Current Revision: 29

Revision type, check one box:

☐ **Only minor changes are needed**; do not check this box if procedural changes are also needed. These minor changes are not affecting how the procedure is performed and not changing requirements or polices are needed. – For minor changes, place an N/A in the corresponding “Date Procedure Change Implemented” box.

X **Procedural revision of the SOP is needed** to reflect current practices. Draft revisions are listed below.

Submitted by: Kurt Clarkson Date: 2/15/2022

SOP Section Number	Description of Revision Needed	Date Procedure Change Implemented	Technical Manager Initials Indicating Approval of Revision
4.1	Add to end of section: ALS views both electronic and hand written signatures as the same. The use of signatures are covered under our Data ethics and integrity policy. Under the data Ethics and Integrity policy, forging another's name or initials is prohibited; this covers all forms of signatures.	2/15/2022	KC
4.2	Change paragraph: The transmittal of final results is specified by clients and follows those requirements unless specific changes are made by the ALS Project Manager assigned to the client/project. Client communication procedures and documentation requirements are listed in SOP *Project Management* (ADM-PCM). To: The transmittal of final results is specified by clients and follows those requirements unless specific changes are made by the ALS Project Manager assigned to the client/project. A statement of confidentiality shall be included on external emails that contain final results. Client communication procedures and documentation requirements are listed in SOP *Project Management* (ADM-PCM).	2/15/2022	KC

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1. Scope

This Quality Assurance Manual (QAM) describes the policies, procedures and accountabilities established by the Laboratory of ALS Environmental (ALS) to ensure that the test results reported from analysis of air, water, soil, waste, and other matrices are reliable and of known and documented quality. This document describes the quality assurance and quality control procedures followed to generate reliable analytical data.

This QAM is designed to be an overview of ALS operations. Detailed methodologies and practices are written in ALS Standard Operating Procedures (SOPs). Where appropriate, ALS SOPs are referenced in this document to direct the reader to more complete information.

ALS maintains certifications pertaining to various commercial and government entities. Each certification requires that the laboratory continue to perform at levels specified by the programs issuing certification. Program requirements can be rigorous; they include performance evaluations as well as annual audits of the laboratory to verify compliance.

Quality Assurance Policy

ALS is committed to producing legally defensible analytical data of known and documented quality acceptable for its intended use and in compliance with applicable regulatory programs. This QAM is designed to satisfy the applicable requirements of the Various States, United States Environmental Protection Agency (USEPA), TNI Volume 1 2009/2016 and ISO 17025: 2017.

ALS corporate management has committed its full support to provide the personnel, facilities, equipment, and procedures required by this QAM and other client and project related requirements.

ALS management reviews its operations on an ongoing basis and seeks input from staff and clients to make improvements.

It is the policy of ALS that all employees be familiar with all quality documentation.

Quality System

This QAM and SOPs referenced in this document comprise the ALS management system. This management system includes all quality assurance policies and quality control procedures.

Although verbal communication with employees is essential, written and visual communication through email and computer systems is the cornerstone of effective communication at ALS. Computer workstations throughout the lab provide access to LIMS, Procedures and email systems. All information essential for effective and consistent communication of analytical requirements and details affecting quality is available through these computerized systems.

Ethics and Data Integrity

It is the policy of ALS to perform work for clients in the most efficient manner possible, avoiding waste of resources. It is the role of both ALS management and employees to ensure that work for clients is performed most efficiently and effectively by properly utilizing ALS purchased materials, equipment, and the time and ability of personnel.

ALS policy on waste, fraud, and abuse is described in ALS SOP *Laboratory Ethics and Data Integrity* (CE-GEN-001). It is the policy of ALS to generate accurate and reliable data in accordance with contractual and regulatory requirements. As stated in the ALS policies manual, any undue pressure applied to employees in the performance of their duties must be reported as per procedures for reporting listed in ALS SOP CE-GEN-001. It is against ALS policy to improperly manipulate or falsify data or to engage in any other unethical conduct as defined in ALS Corporate SOP CE-GEN-001. ALS provides mandatory initial and annual refresher training for all employees on SOP CE-GEN-001.

Data integrity training is provided as a formal part of new employee orientation and a refresher is given annually for all employees as detailed in the Ethics and Data Integrity corporate SOP CE-GEN-001. Key topics covered are the organizational objective and its relationship to the critical need for honesty and full disclosure in all analytical reporting, record keeping, and reporting data integrity issues. Training includes discussion regarding all data integrity procedures, data integrity training documentation, in-depth data monitoring and data integrity procedures. Training topics also cover examples of improper actions, legal and liability implications (company and personal), causes, prevention, awareness, and reporting options. Computer security is also included, covering ALS computing security awareness, passwords and access, and related topics. Employees are required to understand that any infractions of the laboratory data integrity procedures shall result in a detailed investigation that could lead to very serious consequences including immediate termination, or civil/criminal prosecution. Evidence of training is maintained by the QA Department. See Appendix C for a copy of the ALS Ethics and Integrity Agreement.

In order to maintain compliance with the requirement to conduct and document ethics and data integrity training annually for all employees, data integrity training will be assigned on the first work day of the calendar year through the ALStar program. This will allow for completion of the training and the proper documentation within the assigned 60 day period. Any employee that does not complete the required data integrity training by the end of the 60 day assigned completion period will be removed from normal laboratory operations until the requirement is met to complete the required annual training by the end of the calendar year.

The pertinent ALS Project Manager must approve deviations from contractual requirements. The Project Manager obtains approval for any such deviations, either in writing or by phone (documented in a phone log) from pertinent contract authorities. In addition, ALS requires that deviations from contractual requirements that might affect data quality be reported to clients. Any employee who knowingly manipulates and/or falsifies data or documents or engages in any unethical conduct is subject to immediate release from employment.

ALS employees who are aware of, or reasonably suspicious of, any case of data manipulation, falsification of data, waste of resources, or other unethical practice or misconduct shall notify any manager. Under the direction of the laboratory director, every allegation of unethical conduct will be fully investigated.

2. Normative References

ALS relies primarily upon the most current EPA approved revisions of the references listed below for methodologies used in the laboratory. Procedures contained in these references are acceptable for use only after the lab has demonstrated and documented adequate performance with the method such as method detection limit studies, precision and accuracy studies, proficiency sample analysis, and linear calibration range studies. These studies are then routinely verified as long as the methods are in use in the laboratory.

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 17025:2017, *General Requirements for the Competence of Testing and Calibration Laboratories*.

TNI 2009 and 2016, VOLUME 1, *Management and Technical Requirements for Laboratories Performing Environmental Analysis*.

DoD/DOE QSM, *Department of Defense (DoD), Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories*.

ISO/IEC Guide 99, *International Vocabulary of Metrology — Basic and General Concepts and Associated Terms* (VIM1).

ISO/IEC 17000, *Conformity Assessment — Vocabulary and General Principles*.

Methods for Chemical Analysis of Water and Wastes, U.S. Environmental Protection Agency, EPA/600/4-79/020, Revised 1983.

Standard Methods for the Examination of Water and Wastewater, American Public Health Association,18th edition, 20th Edition, 21st Edition, 22nd edition, on-line.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA SW-846, Third Edition, 1986, Updates I, II, IIA, IIB, III, IIIA, IIIB, IV, IVA, and IVB.

40 CFR Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants.

40 CFR Part 141, National Primary Drinking Water Regulations.

Methods for the Determination of Organic Compounds in Drinking Water, EPA 600/4-88/039, Rev. July 1991; Supplement I, EPA 600/4-90/020, July 1990; Supplement II, EPA 600/R-92/129, August 1992; Supplement III, EPA-600/R-95/131, August 1995.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA 600/R-93/100, August 1993.

Methods for the Determination of Metals in Environmental Samples, Supplement EPA 600/4-88/039, Rev. July 1991; Supplement I, EPA 600/R-94/111, July 1990; Supplement II, EPA 600/R-92/129, August 1992.

Methods for the Determination of Organic and Inorganic Compounds in Drinking Water, Volume 1, EPA815-R-00-014.

Annual Book of ASTM Standards.

3. Terms and Definitions

- Impartiality - presence of objectivity.
- Complaint - expression of dissatisfaction by any person or organization to a laboratory (3.6), relating to the activities or results of that laboratory, where a response is expected.
- Inter-laboratory comparison - organization, performance and evaluation of measurements or tests on the same or similar items by two or more laboratories in accordance with predetermined conditions.
- Intra-laboratory comparison - organization, performance and evaluation of measurements or tests on the same or similar items within the same laboratory in accordance with predetermined conditions.
- Proficiency testing - evaluation of participant performance against pre-established criteria by means of inter-laboratory comparisons.
- Laboratory - body that performs one or more of the following activities:
  - — testing;

— calibration;

— sampling, associated with subsequent testing or calibration

- Decision rule - rule that describes how measurement uncertainty is accounted for when stating conformity with a specified requirement.
- Verification - provision of objective evidence that a given item fulfills specified requirements.
- Validation - verification, where the specified requirements are adequate for an intended use.

4. General Requirements

4.1 Impartiality

All employees are required to enter into the following agreements:

- **Code of Conduct Agreement**

  Provides a framework for decisions and actions in relation to conduct in employment. The agreement covers a wide range of topics including personal and professional behavior, conflicts of interest, gifts, confidentiality, legal compliance, security of information, among others. The code of conduct agreement is administered by the USA Human Resources department. This agreement is provided to the employee during the hiring and induction process and the agreement is reviewed and signed.

- **Confidentiality Agreement**

  Describes policies for identifying and protecting information owned by ALS and its customers, and for keeping this information in confidence. The confidentiality agreement is administered by the USA Human Resources department. This agreement is provided to the employee during the hiring and induction process and the agreement is reviewed and signed.

- **Ethics and Data Integrity Agreement**

  Provided to the employee as part of the hiring and induction process, and reviewed during periodic ethics refresher training. This is coordinated between the Human Resources and Quality Assurance (QA) departments. This agreement is provided to the employee during the hiring and induction process and the agreement is reviewed and signed. All employees are required to take annual ethics and data integrity refresher training.

In addition to the agreements, project managers act as a firewall to insulate the analysts from clients so that the lab personnel have no contact with clients. Lab IDs are assigned to samples and used throughout preparation and analysis to make the samples ambiguous to lab personnel. Together these agreements and procedures ensure freedom from undue internal and external commercial, financial, and other pressures or influences that could adversely affect the quality of work. They protect customers' confidential information and ALS' proprietary rights. They ensure avoidance of activities that could diminish confidence in the competence, impartiality, judgment or integrity of any ALS laboratory and staff.

It is the responsibility of all staff to comply with all procedures, be familiar with current management systems and policies, and to record all data as established by management. This and the peer review of all data will ensure that all testing is objective and conflicts of interest do not exist. As a commercial laboratory, the decision making using test results, opinions and interpretation of data is outside the scope of the laboratory activities.

4.2 Confidentiality

All employees signed confidentiality statement upon employment. These are maintained by Human Resources (HR).

Documents provided to the laboratory are held in strict confidence by project management staff. Documents pertaining to quality assurance and analytical requirements are reviewed with appropriate managers and staff through the project specific meetings and LIMS. Project related information provided by clients is securely archived using procedures described in the SOP *Data Archiving* (ADM-ARCH).

The transmittal of final results is specified by clients and follows those requirements unless specific changes are made by the ALS Project Manager assigned to the client/project. Client communication procedures and documentation requirements are listed in SOP *Project Management* (ADM-PCM).

5. Structural Requirements

5.1 The laboratory, a legal entity, is part of ALS USA Corp and the Laboratory Director reports to the General Managers, Life Sciences, USA. There are other support functions such as human resources, accounting, safety oversight and computer systems that are provided to the laboratory by corporate entities but none of which is responsible for managing laboratory activities. The support functions of this laboratory involved with testing and services are under the direction of the laboratory director.

5.1.1 Limitation of Liability

Notwithstanding any other provision herein, ALS's liability and Client's exclusive remedy for any cause of action arising hereunder, whether based on contract, negligence, or any other cause of action, shall be limited to the compensation received by ALS from the Customer for the services rendered therewith. All claims, including negligence or any other cause whatsoever shall be deemed waived unless made in writing and received by ALS within ninety (90) days after ALS's completion of the services provided.

5.1.2 Transfer of Ownership

In the event of a transfer of ownership of the laboratory, the new owner will agree in writing, which shall be either stipulated in a purchase agreement or as a separate record retention document, that the current records shall be maintained for a period of not less than ten (10) years.

5.1.3 Laboratory Closure

In the event of a laboratory closure, the current owner/management will notify in writing all Customers for whom the laboratory performed sample analysis within the last ten (10) years that the laboratory will be closing. This letter will instruct the Customers to contact the laboratory to provide instructions on how previous records are to be transferred to the Customer's care.

5.2 The responsibility for this laboratory under the direction of the laboratory director. Key employees in the management systems are identified in section 5.5.

5.3 This laboratory performs a full range of inorganic and organic analyses using EPA SW-846 methods, EPA drinking water methods per 40CFR141, EPA Clean Water Methods per 40CFR136, AWWA Standard Methods current approved methods, and Accreditation agency or State Approved Methodologies;. This QAM is designed to be an overview of ALS operations. Detailed methodologies and practices are written in ALS Standard Operating Procedures (SOPs). Where appropriate, ALS SOPs are referenced in this document to direct the reader to more complete information.

5.4 ALS is committed to producing legally defensible analytical data of known and documented quality acceptable for its intended use and in compliance with applicable regulatory programs. This QAM is designed to satisfy the applicable requirements of various states, United States Environmental Protection Agency (USEPA), TNI Volume 1 2009 or 2016 and ISO 17025: 2017.

5.5 **Org Chart and Key personnel** - see Appendix B.

5.5.1 **ALS Laboratory Director**, The Laboratory Director is responsible to ensure:

- Implementation of quality policy and applicable standards.
- Employees have sufficient experience and training to perform QAM related duties and procedures.
- That the necessary facilities and equipment are available to meet the commitments of the laboratory.
- Sample handling, instrument calibration, sample analysis, and related activities are conducted and documented as described in this QAM, its related Standard Operating Procedures (SOPs), and its referenced methods.
- That routine QC samples are prepared, analyzed, and reviewed as required by this QAM.
- That at regular intervals audits are conducted and documented to assess compliance with this QAM.
- That corrective action is initiated and completed to remedy discrepancies or problems identified in any laboratory process.
- Management review of all processes and procedures associated with the management system.
- In the absence of the Laboratory Director, either the Metals Technical Director or Client Service Manager will assume the above responsibilities. This will require assistance from corporate leadership.

5.5.2 **Quality Assurance Manager**, The Quality Assurance Manager reports directly to the laboratory Director and is responsible to:

- Ensure implementation of quality policy and applicable standards.
- Understand, monitor and evaluate the quality assurance (QA) and quality control (QC) activities described in this QAM and its references, reporting deficiencies and identifying resource requirements to the Laboratory Director.
- Conduct and document an annual internal audit of laboratory procedures to ensure compliance with this QAM and its references.
- Conduct an annual update of this QAM and review or update laboratory Standard Operating Procedures (SOPs).
- Arrange for the analysis of Proficiency Testing (PT) samples and maintains training records of demonstration of competency (DOC).
- Maintain a record of ongoing personnel training for QAM related activities, reporting training deficiencies to the Laboratory Director.
- Maintain the laboratory documentation of nonconformance, corrective action, preventive action, and improvement programs.

- In the absence of the QA Manager, the Laboratory Director shall assume the above responsibilities. This may require assistance from the corporate Quality Improvement Manager, especially in the event of a prolonged absence.

5.5.3 **Technical Managers (Organic & Inorganic)**, The managers of these operations report directly to the Laboratory Director and are responsible to:

- Ensure implementation of quality policy and applicable standards.
- Read, understand and follow this QAM with its references.
- Ensure that method development projects meet the requirements specified in this QAM.
- Ensure that each set of reported results meets the requirements specified in this QAM and meets the client's requirements as defined in the applicable project requirements.
- Ensure that personnel are trained, authorized and utilized effectively.
- Ensure that facilities and equipment are maintained and utilized effectively.
- Ensure that supplies are available and utilized effectively.
- Immediately report technical and quality problems to the Laboratory Director or Quality Assurance Manager.
- In the event of a prolonged absence of the Organic or Inorganic manager, Supervisors within the department that possess the required qualifications and experience will assume the above responsibilities.

5.5.4 **Project Managers**, Project Managers report directly to the Client Services Manager. Project Managers are responsible to:

- Ensure implementation of quality policy and applicable standards.
- Complete and distribute project related information for each project before the laboratory starts work on the project.
- Immediately communicate to the laboratory changes made to projects in progress and document these changes as appropriate.
- Respond to client requests for information and coordinate responses to client audits.
- Ensure StarLIMS work orders are reviewed and meet client project requirements before release to the laboratory.
- Perform an initial review of results for large projects to verify that data reports submitted to the client meet all project requirements.
- Operate as approved signatories for laboratory reports.

5.5.5 **Support Management** (Computers, Client Services, Health and Safety) are responsible to:

- Ensure implementation of quality policy and applicable standards.
- Read, understand and follow this QAM with its references.
- Ensure that procedures are followed and meets the client's requirements as defined in the applicable project requirements.

- Ensure that personnel are trained, authorized and utilized effectively.
- Ensure that facilities and equipment are maintained and utilized effectively.
- Ensure that supplies are available and utilized effectively.
- Immediately report technical and quality problems to the Laboratory Director or Quality Assurance Manager.
- Training staff to comply with all processes.

5.6 It is the responsibility of all technical and support staff to comply with all procedures and be familiar with current quality systems and policies as established by management. At ALS, improvement of the quality systems and preventive action is effected through an ongoing systems review by management using input from all staff. ALS actively seeks employee and client input for improvements through surveys and questionnaires. Internally ALS maintains a process improvement website for employees to provide suggestions for improvements. For clients, ALS surveys and gains feedback on services provided. This input to management is provided from the corporate level. To comply with these requirements all staff are responsible but not limited to the following:

- Follow project requirements as delineated by project managers to ensure analyses and commitments, including TAT, are performed as requested.
- Develop knowledge and understanding of the QAM requirements under which samples are handled and tested.
- Notify managers and Quality Assurance personnel when QA problems arise.
- Follow Quality Assurance requirements as outlined in the QAM and SOPs.
- Follow appropriate channels regarding modification of existing SOPs.
- Maintain accurate electronic and written records.
- Ensure that applicable data are included in each process in accordance with applicable SOPs.
- Record all nonconformance.
- Follow appropriate protocols when the handling and testing does not meet acceptance criteria.
- Apply integrity and professional judgment when dealing with analytical processes and laboratory operations.

5.7 Although verbal communication with employees is essential, written and visual communication through email and computer systems is the cornerstone of effective communication at ALS. Computer workstations throughout the lab provide access to LIMS, ALS Portals, Instruments used for testing, Policies and Procedures, and Email. All information essential for effective and consistent communication of analytical requirements, client requirements and details affecting quality are available through these computerized systems.

ALS management is committed to improvements of the management systems through compliance with its own policies and procedures. ALS management ensures improvements are made to the management systems and also ensures data integrity is maintained.

6. Resources Requirements

6.1 General

6.1.1 ALS management has committed its full support to provide the personnel, facilities, equipment, and procedures required by this QAM.

6.2 Personnel

6.2.1 It is the responsibility of all staff to comply with all procedures, be familiar with current management systems and policies, and to record all data as established by management. This will ensure that all testing is objective and conflicts of interest do not exist. As a commercial laboratory, the decision making using test results is outside the scope of the laboratory activities. The ALS laboratory employs sufficient personnel to complete required chemical and radiochemical analyses and support activities.

6.2.2 The ALS training program specified in the SOP *Employee Training and Orientation* (ADM-TRAIN) includes quality training, technical training, safety training, and other training as described in this QAM. ALS managers are responsible to ensure that all staff training is initiated, completed, verified, and documented.

The specific training and experience of laboratory personnel is documented in individual training files maintained in accordance with ADM-TRAIN and includes records of analytical proficiency through the analysis of QC and PT samples.

Job Descriptions include requirements for education, qualification, training, technical knowledge, skills and experience. Job descriptions are maintained by the corporate Human Resource Department.

6.2.3 All ALS staff assigned to perform tasks affecting or relating to testing receives training relative to pertinent areas of responsibility, both prior to performing work on client samples and on an ongoing basis. Such training comes from internal and external sources.

6.2.4 Laboratory personnel resources needed to carry out their duties. See 5.6.

6.2.5 The laboratory procedure *Employee Training and Orientation* (ADM-TRAIN), includes the following and records are retained for:

- Determining the competence requirements.
- Selection of personnel.
- Training of personnel.
- Supervision of personnel.
- Authorization of personnel.
- Monitoring competence of personnel.

6.2.6 It is the responsibility of Technical and Support Management to authorize staff to perform specific laboratory activities. These tasks include testing methods, peer review and authorization to report results. Records are retained for the pertinent authorizations by the Quality Assurance department.

6.3 Facilities and Environmental conditions

6.3.1 ALS management has committed its full support to provide the personnel, facilities, equipment, and procedures required by this QAM.

6.3.2 Records are maintained for the requirements and conditions necessary for method and regulatory compliance in the facility.

6.3.3 Records are retained with analytical data for monitoring and control of environmental conditions to relevant method and regulatory specifications.

6.3.4 See Appendix D for floor plan.

To maintain facility security and thus sample security, entrance to the ALS facility can be attained only through security access, except at the main business entrance and sample receiving entrance; these are open only during normal business hours and monitored by the receptionist at the business entrance and Sample Receipt Technicians at the sample receiving entrance. All non-employees are required to sign in with the receptionist at the main entrance.

Laboratory areas are segregated by HVAC systems to contain contamination and to eliminate potential contamination from specific laboratory areas that require low ambient chemical background levels for successful analysis.

Each area in the laboratory has adequate lighting, conditions and bench space for instrumentation and for the processes assigned to that area.

Laboratory reagent water is prepared and maintained using any combination of deionization, reverse osmosis, purging and UV radiation. See SOP *Operation and Maintenance of Laboratory reagent Water Systems* (FAC-WATER).

Fume hoods have visual indicators to ensure flow is maintained during use and are performance tested semi-annually.

All safety inspection records are kept on file for a minimum of five years.

6.3.5 Laboratory activities outside the facility are limited to sample pick-up and sample collection. Field service activities are not included in our laboratory scopes of accreditation/certification.

6.4 Equipment

6.4.1 A comprehensive list of instrumentation and support equipment utilized at ALS is included in Appendix E. Redundant instruments are maintained for particular analyses.

6.4.2 Laboratory equipment items such as analytical balances, pipettes, and thermometers are verified against reference standards. Laboratory reference weights and thermometers are certified by ISO accredited vendors against ISO or National Metrology Institute (NMI) traceable standards. Support equipment is maintained in proper working order and verified daily or prior to use. Support equipment is calibrated or verified as described by the SOPs *Documenting Laboratory Balance and Check Weight Verification* (ADM-BAL) and *Checking Volumetric Labware* (ADM-VOLWARE).

In the event that equipment is sent outside of the laboratory, such as a NIST thermometer, for calibration, the device shall be inspected by the laboratory prior to being put into use. If found to be of the appropriate quality per the SOP and functioning properly, the Certificate of Calibration will be maintained on file.

6.4.3 Routine maintenance is performed on laboratory instruments and equipment according to manufacturer recommendations. Maintenance is provided under warranty, through service contracts, and by ALS in-house personnel. The ALS approach to preventive maintenance is described in each analytical SOP. Records of routine maintenance and emergency maintenance are kept with the instruments or on the ALS server in hardcopy or electronic maintenance logbooks.

a) Maintenance logs contain general information about the instrument, such as the name of the manufacturer, instrument model, serial number, date of purchase, date placed into service, current instrument location, condition when received (e.g., new, used, reconditioned), and information concerning any service contracts maintained. They also contain information concerning any routine maintenance done by ALS personnel. Information concerning maintenance should include a brief description of the maintenance performed, the frequency required, the date performed, and the initials of personnel performing the maintenance and any comments concerning the procedure. Also to be entered in or to be stored with the log is information concerning repairs done by ALS personnel or instrument manufacturers. This information should include the date of servicing, the initials of personnel performing the service, record of why it was done and the results of the servicing relative to instrument performance. The individual logbooks are located on the server or in the laboratory with the instruments to which they pertain along with copies of manufacturer's instructions, where available. Records shall be retrievable for review and archived according to required procedures. See *Records Management* Policy, (ADM-RCRDS).

b) It is the responsibility of the technical managers to determine the effect, if any, of an instrument defect on previous results. If an effect has been determined to have impacted the validity of any sample results, the corrective action procedure is followed. See Nonconformance and Corrective Action Procedures (ADM-NCAR).

6.4.4 All instruments are calibrated or verified before use, using reference materials with traceability established. Specific calibration requirements are detailed in the method or analytical SOP.

a) Initial calibrations are verified for accuracy by analysis of a second source standard. This is a check standard prepared from a reference material procured from a different source than that used for the calibration. When a different source is not available or cost prohibitive, a second lot of material from the same vendor is acceptable as long as the original source used to prepare the standards is not the same.

b) All initial calibrations are verified by analysis of continuing calibration standards and/or QC check samples. These are method or SOP specified calibration standards that are analyzed at specific frequencies as established by the method. The amount of analyte recovered is compared to the acceptance criteria of the method. Acceptable recoveries verify the stability of the calibration and lack of instrument drift throughout the analysis. Analysts perform trend analysis by monitoring instrument response and QC each day of analysis. If the acceptance criteria are not met, or sensitivity is determined to be changing, method specific corrective action must be taken. (See analytical SOPs).

6.4.5 The instrument manuals are provided in electronic format usually in the software programs, CDs, and available on network drives. Software is controlled through licensing and is the responsibility of computer support to maintain licenses required.

6.4.6 Testing instruments are calibrated as per method, regulatory and verification procedures listed in SOPs. Support equipment has verification and calibration frequencies specified in SOPs.

6.4.7 Calibration program. See 6.4.4

6.4.8 Calibration and verification period are designated in support equipment and analytical method SOPs. This equipment is labeled with calibration or verification dates.

6.4.9 Equipment that has been subjected to overloading or mishandling, gives questionable results, or has been shown to be defective or outside specified requirements, is taken out of service. It shall be recalibrated and not returned to service until it has been verified to perform correctly. The laboratory shall examine the effect of the defect or deviation from specified requirements and shall initiate the nonconformance process as outlined in *Nonconformance and Corrective Action Procedures* (ADM-NCAR).

6.4.10 Support equipment is verified on the day of use and calibration verification is required on analytical instruments as per method, program and SOP requirements.

6.4.11 All reference materials ordered by ALS have available documentation of purity, traceability and uncertainty.

6.4.12 Passing verification criteria ensures that unintended adjustment of equipment is identified.

6.4.13 Records of instruments are retained and include specifications, manufacturer, serial numbers, identification, software version, location, status and the date of purchase. The majority of firmware has no impact on laboratory activities. There are some instruments in which the firmware is the software and can affect the laboratory operations. These instruments are usually small like pH meters, conductivity meters and auto-titrators. If an instrument does not have typical software to load and firmware is used to generate results, then the firmware version must be entered in the instruments record log and any updates to the firmware will be noted in the instrument maintenance log.

6.4.14 Records of calibration, maintenance, reference materials used, calibration checks or verifications are kept with analytical data.

6.5 Metrological Traceability

6.5.1 All measurements made by the laboratory required an unbroken chain to NMI, Reference Standards or Reference Materials.

6.5.2 Reference Standards and Reference Materials

a) Reference Standards

Reference standards used by the laboratory are calibrated at determined intervals by outside vendors for the following equipment. These reference standards are maintained under the control of QA personnel and are used for verifying intermediate materials used by the laboratory. Quality Assurance is responsible for maintaining records and schedules of calibration.

Intermediate checks are used in the laboratory to verify performance of support equipment and are verified to traceable reference standards. Records of such verifications are retained by Quality Assurance. See SOP *Documenting Laboratory Balance and Check Weight Verification.* (ADM-BAL).

b) Reference Materials

Reference materials used at ALS must be of the grade or quality specified by the pertinent analytical procedure or methodology.

Purchased reference materials must be traceable to a National Metrology Institute (NMI) or equivalent national or international standards where possible.

6.5.3 Reference Standards are calibrated by vendors certified to ISO 17025: 2017.

Reference Materials are purchased, whenever possible. ALS uses reference materials from Guide 34 or ISO 17034 accredited vendors.

Second source reference materials are purchased and used in the testing process as an independent verification of primary reference materials. The secondary reference material does not require accredited vendors.

a) The reference standards used are those specified in the reagent sections of the respective analytical SOP.

b) If reference materials from Guide 34 or ISO 17034 accredited vendors are not available, reference standards of the best purity and quality from a reputable supplier may be used. Determination is made by the laboratory with careful study and consideration of the chemically pure substances available.

c) All purchased reference standards are received and verified for accuracy against the invoice. They are transferred to the appropriate department where they are entered into the standards logbooks which may be either hardcopy or electronic.

d) Certificates of Analysis are either maintained by the ordering department. The CoA may be archived either in hardcopy, or preferably electronically.

e) All purchased reference standards are received and verified for accuracy against what was ordered. The standards are entered into the inventory control system. The certificate of Analysis is saved by the department in either electronic or hardcopy format.

f) Any standard reference material which is past its expiration date is removed from analytical use. Expired standards may be used for research purposes only and must be kept separate from standards used for the routine analysis of samples.

6.5.4 Reagents

The quality level of reagents and materials (grade, traceability, etc.) required is specified in analytical SOPs. Department supervisors ensure that the proper materials are purchased. Inspection and verification of material ordered is performed at the time of receipt by receiving personnel. The receiving staff labels the material with the date received. Expiration dates are assigned as appropriate for the material. Storage conditions and expiration dates are specified in the analytical SOP. *Quality of Reagents and Standards* (ADM-REAG) and *Reagent and Standards Login and Tracking* (ADM-RLT) provides default expiration requirements. Supplies and services that are critical in maintaining the quality of laboratory testing are procured from pre-approved vendors. The policy and procedure for purchasing and procurement are described in SOP *Procurement and Control of Laboratory Services and Supplies* (ADM-PROC).

Receipt procedures include technical review of the purchase order/request to verify that what was received is identical to the item ordered. Verification that the chemical or reagent purchased is of the correct purity and traceability is performed by comparison of the acquired reagent to reagent listed in the SOP *Reagent and Standards Login and Tracking* (ADM-RLT).

Each lot of chemical or reagent used is monitored and controlled for any unusual contaminants that interfere with analysis as evident in results of prescreens and/or method and reagent blanks. If a working reagent is found to be suspect, it is removed from use and traced back to the original lot number, which is then investigated. If the stock reagent is found to be the source of the problem, it is completely removed from use. Any samples contained in batches in which the suspect reagent was used for analysis will be reanalyzed if sufficient remaining sample and holding time allows, or clients will be contacted and results appropriately qualified with a sample or analyte level comment on the final report. See SOP *Reagent and Standards Login and Tracking* (ADM-RLT) for procedure to verify targeted critical reagents.

6.6 Externally Provided Products and Services

6.6.1 Analytical services are subcontracted when the laboratory needs to balance workload or when the requested analyses are not performed by the laboratory. Subcontracting is only done with the knowledge and approval of the client and to qualified laboratories. Subcontracting to another ALS Environmental Group laboratory is preferred over external-laboratory subcontracting. Further, subcontracting is done using capable and qualified laboratories. Established procedures are used to qualify external subcontract laboratories. These procedures are described in SOP *Qualification of Subcontract Laboratories and Internal Subcontracting Protocol* (ADM-SUBCONT).

a) ALS advises its customers in each proposal of its intention to subcontract any portion of the testing to a third party, or non-ALS laboratory. If it is necessary to subcontract fork to a non-ALS laboratory as a result of unforeseen circumstances, customers will be contacted by their project Manager to gain their permission. This approval is documented by the Project Manager.

b) Any subcontracted analysis is noted as such on ALS's final report with an identification of the appropriate subcontractor. The original subcontractor analysis report, or a true duplicate thereof, is also attached to the associated ALS laboratory report.

Procurement and Control of Laboratory Services and Supplies (ADM-PROC) outlines the process, evaluation, criteria and records maintained from the evaluation and reevaluation of supplies and services. Corporate personnel are responsible for vendor approval and evaluation. Records are maintained by the corporate purchasing office.

Processes are designed to ensure that materials and services purchased meet the quality specifications of ALS. Procurement and receiving services are provided at ALS by administrative personnel. Procurement and receiving quality requirements established by ALS are followed. All requisitions for purchase are approved by ALS operations management and specify 1) the level of service required or 2) the quality/specifications of material required. The receipt of materials not meeting specification in the purchase requisition require investigation.

7. Process Requirements

Review of Requests Tenders and Contracts

Project Managers are responsible for maintaining, archiving, and retrieving all contracts, project requirements and QAPPs provided to ALS by clients and related to projects completed by ALS. They are also responsible for the destruction of materials provided on unsuccessful proposals and bidding opportunities. Specific procedures for client communication and required documentation are listed in the SOP *Project Management* (ADM-PCM).

Selection, Verification, and Validation of Methods

Reference methods for environmental samples are drawn primarily from the current version of Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Third Edition. Reference methods for water analysis are taken from Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March, 1983 with its updates, and from 40 CFR, Part 136. Methods referenced in ALS SOPs also come from ASTM guides, and from Standard Methods for the Examination of Water and Waste Water.

Reference Methods for microbiology are from Standard Methods for the Examination of Water and Wastewater.

SOPs are written for all environmental testing methods, any modified reference methods for industrial hygiene testing and any in-house developed methods. SOPs may be copies of reference methods that are not modified. All SOPs are reviewed using document control procedure. See SOP *Establishing Standard Operating Procedures* (ADM-SOP).

All analytical methods and preparatory method combinations are routinely tracked and ALS maintains statistical control limits and reporting limits. The laboratory can perform using limits provided by clients or from referenced sources in the absence of historical data. The SOP *Trending, Control Charts, and Uncertainty* (ADM-TREND) describes how control limits are established and updated.

ALS policy is that all SOPs be compliant with the reference method. In the event that several methods are referenced in an SOP, all procedures must be compliant with all referenced methods. All SOPs include a section describing changes and clarifications from the reference method. In the event that an analytical method is modified, the SOP documentation must include a description of the modification, any justification of the method modification which includes, but is not limited to, method performance and recovery data, any other supporting data, and approval from the Technical Managers, Quality Assurance Manager, and Laboratory Director. In the event that an analytical method must be modified or is modified to perform on specific sample matrices, the modification and reason must be stated in the case narrative. All modified methods will be identified on the analytical report.

The policy of ALS is to apply analytical methods that have been approved, validated, and published by government agencies, professional societies and organizations, respected private entities, and other recognized authorities. These methods have been validated for their intended use and ALS uses the demonstration of competency procedures, calibration of instruments and LOD/LOQ procedures to verify laboratory capability.

Published methods may be modified as a result of the request of the client or operational conditions prevailing in the laboratory. Operational conditions might relate to, for example, the availability of equipment or the performance of the method as determined by calibration processes, detection limits, or the results obtained for quality control samples.

Validation procedures describe three different classifications of validations for method modification. New methods, permanent modifications to a published method which will be used in subsequent laboratory determinations, and temporary modifications applied only to immediate analytical projects. These methods are used with approval from the clients.

The essential quality control elements for modification and validation include:

Calibration – The number of levels and acceptance criteria must meet or exceed requirements of ALS analytical SOPs. Additional criteria for organic chromatography methods are included in *Calibration of Instruments for Organic Chromatographic analyses* (SOC-CAL).

QC Samples - QC samples prepared in the specific matrix, are assessed. If possible the recoveries are compared to method or historical control limits used for the reference method.

Sensitivity - Method Detection and Reporting Limit, Method Detection Limit is the lowest analyte concentration that produces a response detectable above the noise level of the system and Reporting Limit is the lowest level at which the analyte can be accurately and precisely measured. Method Detection Limits, if required, are generated. A reporting limit verification is accomplished using SOP *Performing and Documenting Method Detection Limit Studies and Establishing Limits of Detection and Quantitation* (ADM-MDL/CE-QA011).

If validation reports are required to validate methods, these reports must address the following elements and follow established testing industry protocols:

Calibration – a demonstration of a concentration range where the analyte response is proportional to concentration.

Sensitivity – Method Detection Limit is the lowest analyte concentration that produces a response detectable above the noise level of the system and Reporting Limit is the lowest level at which the analyte can be accurately and precisely measured.

Selectivity - the ability of the method to accurately measure the analyte response in the presence of all potential sample components.

Precision and Bias - Precision – the type of variability that can be expected among test results. Bias - systematic error that contributes to the difference between the mean of a large number of test results and an accepted reference value.

Robustness – the ability of the procedure to remain unaffected by small changes in parameters or matrix.

7.1 Sampling

In order to produce meaningful analytical data, ALS must have samples that are representative of the system from which they were taken. If the representation and integrity of the samples received in the laboratory cannot be verified due to inadequate sampling procedures, the usefulness of the analytical data produced for these samples is limited. The laboratory cannot accept responsibility for improper sampling of client-procured samples and will document the condition of the samples and analyze them as received. If an incorrect sampling procedure is suspected, the client will be notified as soon as possible by the Project Manager. ALS will postpone testing, if the holding time will not be exceeded, pending client response. Sampling instructions and acceptance criteria are made available to clients.

Where sampling, as in obtaining sample aliquots from a submitted sample, is carried out as part of the test method, the laboratory uses documented procedures as outlined in SOP *Subsampling and Compositing of Samples* (SOILPREP-ALIQUOT) to obtain a representative sub sample.

7.2 Handling of Test or Calibration Items

Procedures for receiving, processing, and storing samples and for ensuring continuity of the chain-of-custody are detailed in the following SOPs: *Sample Receiving* (SMO-GEN) and *Sample Tracking and Internal Chain of Custody* (SMO-SCOC).

The ALS Sample Receiving area is isolated from areas of the laboratory where analyses are performed. The area is equipped with ventilation hoods and adequate bench space to ensure that the sample receiving process is safe, efficient, and not a source of cross-contamination in the laboratory.

Sample Tracking

Sample handling in the laboratory is tracked using a computer-based Laboratory Information Management System or through the signatures on the hand-carried chain of custody documents. After samples are received by the laboratory, as described above, sample receiving personnel enter the sample information into the LIMS. See *Sample Receiving* (SMO-GEN) and *Sample Tracking and Internal Chain of custody* (SMO-SCOC).

When multiple analyses require splitting a sample, the custody documents are copied such that each split can be independently traced to its origin and appropriate entries can be entered into LIMS.

Sample Storage and Security

Following receipt, samples are stored in accordance with analytical method requirements for storage and preservation. Water samples for organic and inorganic analysis are stored in trays and placed in refrigerators in the designated analysis laboratory. Soil samples will be forwarded to the SoilPrep group for Aliquoting. Samples to be analyzed for volatile testing are stored separately from all other samples in a refrigerator. See *Sample Receiving* (SMO-GEN) and *Sample Tracking and Internal Chain of custody* (SMO-SCOC).

To maintain facility security and thus sample security, entrance to the ALS facility can be attained only through security access, except at the main business entrance and sample receiving entrance; these are open only during normal business hours and monitored by administrative personnel at the business entrance and Sample Receipt Technicians at the sample receiving entrance. All non-employees, other than those delivering samples, are required to sign in at the main entrance.

Chain-of-Custody

In order to ensure that legally defensible data are produced at ALS, chain-of-custody procedures are established and are described in SOP *Sample Tracking and Internal Chain of Custody* (SMO-SCOC).

7.3 Technical Records

ALS maintains records on the most part electronically and in accordance with SOP *Records Management* (ADM-RCRDS). ALS personnel are responsible for the retention, retrieval, and disposition of final records of laboratory data and activities. This includes: data packages, analyst laboratory notebooks, instrument maintenance logs, and training records, as established by procedure.

Data Packages - All documentation which pertains to the analysis of a sample or group of samples that are being reported together must be compiled as a data package. The SOP *Report Generation* (ADM-RG) address the preparation and control of data packages.

Electronic records or scans of records that relate to the analysis of field samples are compiled into folders on network drives for storage. These data packages are generally stored electronically as per SOP *Records Management* (ADM-RCRDS). Unless specified by contract, applicable statute, or program, data packages are retained for ten years.

Laboratory Notebooks and Logbooks - Laboratory notebooks and logbooks are retained by ALS for ten years and are not released to clients. Laboratory notebooks are assigned to specific analysts or areas. If corrections are made it requires a single-line cross-out, initials and date are entered. In some instances the reason for the change should be documented.

Quality Assurance Records - Quality control sample results data are retained in LIMS. Records of internal audits, nonconformance reports, and corrective action reports are retained and stored electronically for an indefinite period on networked drives.

The Quality Assurance Manager is responsible for maintaining and retrieving all records of audits, proficiency testing results, demonstration of competency, nonconformance and corrective action records and reports. Some of these records can be internally accessed by employees on network drives.

Client-Related Information - Project Managers are responsible for maintaining, archiving, and retrieving all contracts, project requirements and QAPPs provided to ALS by clients and related to projects completed by ALS. They are also responsible for the destruction of materials provided on unsuccessful proposals and bidding opportunities. Specific procedures for client communication and required documentation are listed in the SOP *Project Management* (ADM-PCM).

ALS ensures that amendments to technical records are tracked to previous versions or to original observations. Both the original and amended data and files are retained, including the date of alteration, an indication of the altered aspects and the personnel responsible for the alterations.

7.4 Evaluation of Measurement Uncertainty

Uncertainty is associated with most of the results obtained in the laboratory testing conducted by ALS. It is meaningful to estimate the extent of the uncertainty associated with each result generated by the laboratory. It is also useful to recognize that this measurement of uncertainty is likely to be much less than that associated with sample collection activities.

In practice, the uncertainty of a result may arise from many possible sources. ALS has considered the relative contribution of major sources of error. The approach to estimating uncertainty adopted by the laboratory resulted in the conclusion that many sources of error are insignificant compared to the processes of sample preparation, calibration, and instrumental measurement. The uncertainty associated with the processes can be estimated from quality control data. Accordingly, ALS estimates uncertainty from data derived from quality control samples carried through the entire analytical process. A description of the uncertainty calculation is presented in SOP *Trending, Control Charts, and Uncertainty* (ADM-TREND). The estimation of uncertainty applied by ALS relates only to measurements conducted in the laboratory. Uncertainty associated with processes conducted external to the laboratory (e.g., sampling activities) are not considered.

Calculation of uncertainty may use the precision measurement values for duplicate samples when LCS or QC samples are not used in testing.

The calculation of uncertainty is not required for qualitative tests. The process is assessed for contributors to uncertainty but the calculation of uncertainty has limited value when empirical values are not available.

7.5 Ensuring the Validity of Results

Before samples are analyzed, the analytical system must be in a controlled, reproducible state from which results of known and acceptable quality can be obtained. That state is verified through the use of Quality Control (QC) procedures intended to ensure accuracy, precision, selectivity, sensitivity, freedom from interference, and freedom from contamination. The QC procedures performed at ALS include: calibration and calibration verification; analysis and comparison of resultant data to predetermined control limits for method blanks, laboratory control samples, spiked matrix samples, duplicate matrix samples, and surrogates added to samples; analysis of performance evaluation samples; determination of Reporting Limits; and the tracking and evaluation of precision and accuracy. For specific analytical methods, other QC procedures are implemented as required by the method.

These QC procedures are performed and evaluated on a batch basis. A preparation batch must not exceed 20 field samples that are of a similar matrix type without additional method QC in the batch, unless specified differently in an SOP or reference method. The samples in a batch are processed together, through each step of the preparation and analysis, to ensure that all samples receive consistent and equal treatment. Consequently, results from the batch QC samples, not including field sample QC, are used to evaluate the results for all samples in the batch.

In general terms, instrument calibration, method quality control, and data evaluation is described in analytical SOPs.

All QC parameters set by the applicable ALS SOP or method reference shall not be exceeded without initiation of a NCAR. See SOP *Nonconformance and Corrective Action Procedures* (ADM-NCAR).

The hierarchy of quality control requirements begins with:

- Client Requirements (if specified and documented).
- Method and/or SOP requirements.
- Guidance from QAM and other general SOPs.

Calibration and Calibration Verification

Instrument calibration is a QC measure taken to verify selectivity and sensitivity. Calibration of instruments at ALS is accomplished through the use of reference materials of the highest quality obtainable. ISO or National Metrology Institute (NMI) traceable reference materials are procured and used if they are available. When ISO or National Metrology Institute (NMI) traceable reference materials are not available, certified reference materials from government agencies or reliable vendors are used. In all cases, written records are maintained that allow all analytical results to be traced unambiguously to the reference materials used for calibration.

In general, analytical instruments are initially calibrated with standard solutions made from the reference materials at levels appropriate for the analysis. This is called the initial calibration (IC). This calibration is verified with a standard solution independently prepared from a different lot of the reference material, preferably from a different vendor. This step is called initial calibration verification or ICV. At specified intervals throughout the analytical sequence, the calibration is re-verified again through the analysis of a calibration check solution, usually the mid-point standard solution. This process is called the continuing calibration verification or CCV. If the IC, the ICV, or any CCV fails criteria in the analytical method, the system is recalibrated or the results are narrated. It is ALS' intention to only report results generated under acceptable calibration conditions. Specific calibration procedures are found in the SOPs associated with each method of analysis.

Alternative calibration sequences or procedures will be discussed with clients.

Calibration parameters set by the applicable SOP or method reference shall not be exceeded without initiation of a NCAR.

Analysis of Method Blanks

The method blank (or preparation blank) contains no sample material; it is treated as a sample in every other way. It is analyzed to monitor any contamination to which the analytical batch might have been exposed during preparation and analysis. A method blank is analyzed with every analytical batch. Criteria set by the applicable ALS SOP or method reference shall not be exceeded without initiation of a NCAR.

Analysis of Laboratory Control Samples and QC Samples

A control sample (LCS or QC) contains the analyte(s) of interest in known concentration(s) in a laboratory matrix; it is used to monitor accuracy. It measures the success of the analysis in recovering the analyte(s) of interest from a QC matrix. Soil samples and other solid matrices are analyzed with an LCS made of clean sand or appropriate substrate spiked with the analyte(s) of interest. Water samples and other liquid matrices are analyzed with a method blank spiked with the analyte(s) of interest.

The results of the LCS are reported as percent recovery:

$$\%\,\text{Recovery} = \frac{X}{K} \times 100$$

Where: X = Measured value
K = Expected value

LCS/QC criteria set by the applicable ALS SOP or method reference shall not be exceeded without initiation of a NCAR.

Analysis of Spiked Matrix Samples

Matrix QC samples are generally used to determine acceptability of methods chosen on a field sample and are therefore not used to determine batch acceptability. If the analysis of matrix spike is not possible, as with industrial hygiene, dietary supplements or other samples of limited matrix amount, a duplicate LCS or QC should be analyzed in the batch.

A known concentration of the analyte(s) of interest is added to a second representative portion of a field sample to prepare a matrix spike. The matrix spike is used to determine acceptability of the method chosen on a specific field matrix. It measures the success of the analysis in recovering the analyte(s) of interest from the type of field sample matrix in the batch. A matrix spike is analyzed with every analytical batch of environmental samples. The results are reported as percent recovery.

$$\%\,\text{Recovery} = \frac{(XS - Xu)}{K} \times 100$$

Where: Xs = Measured value in the spiked sample
Xu = Measured value in the unspiked sample
K= Expected value

Laboratory criteria will be used in the absence of client-specified criteria. Failure to meet these criteria will be noted as per client instructions.

Analysis of Duplicate Matrix Samples

Matrix QC samples are generally used to determine acceptability of methods chosen on a field sample and are therefore not used to determine batch acceptability. If the analysis of matrix spike is not possible, as with industrial hygiene, dietary supplements or other samples of limited sample amount, a duplicate LCS or QC should be analyzed in the batch.

A duplicate matrix spike sample or duplicate matrix sample is used to monitor the precision (repeatability) of the method chosen on a field sample. If a sufficient amount of the analyte(s) of interest is present in the field sample, a matrix duplicate sample is analyzed directly. If the analyte(s) of interest are not present in a sufficient amount, two additional portions of field sample are spiked with the analyte(s) of interest to ensure that meaningful results are obtained. A pair of duplicate samples (matrix/matrix duplicate or matrix spike/matrix spike duplicate) is analyzed with every analytical batch of environmental samples. The results of the analysis of duplicate samples are reported as relative percent difference (RPD).

$$RPD = \frac{|X1 - X2|}{[(X1 + X2)/2]} x\,100$$

Where: $|X_1 - X_2|$ = The absolute value of the difference between the two sample values

$[(X_1 + X_2)/2]$ = The average of the two sample values

Laboratory criteria will be used in the absence of client-specified criteria. Failure to meet these criteria will be noted as per the analytical SOP instructions, or as per client instructions for project specific requirements.

Analysis of Surrogates Added to Samples

Surrogates are compounds similar to the analyte(s) of interest but that are known not to be present in the environment. Examples are fluorinated or deuterated homologues of the organic analyte(s) of interest. When appropriate compounds are available, their use is specified in the analytical method SOP. When surrogates are used, they are added to the calibration solutions and to each field and QC sample in the batch. Surrogate recovery is a measure of the accuracy and selectivity of the method in the sample matrix. Surrogate results are reported as percent recovery.

$$\%\,Recovery = \frac{X}{K} x\,100$$

Where: X = Measured value
K = Expected value

Surrogate criteria set by the applicable SOP or method reference on method QC samples shall not be exceeded without initiation of a NCAR.

The same criteria will be used for field samples although failure to meet these criteria will be noted in report, narrative comments, or as per client requirements.

Reporting Limit Verification Sample(s) (RLVS)

An RLVS is a control sample that contains the analyte(s) of interest at or below the stated reporting limit(s) in an applicable QC matrix; it is used to monitor sensitivity and assess uncertainty at the reporting limit. These samples are not used for batch acceptance and should be recovered at ≥½ the stated reporting limit. The analyst shall raise the reporting limit if systematic failures are apparent.

- An RLVS is required for every sample batch for environmental and industrial hygiene testing.
- Reporting limits must be at or above the lowest calibration standard.

Analysis of Performance Evaluation Samples (PT)

Proficiency testing (PT) samples are prepared by an authorized independent organization outside the laboratory. They are received and analyzed at regular intervals to monitor laboratory accuracy. ALS Laboratories sends the PT sample results to the independent organization, where they are evaluated and then forwarded directly from that organization to accreditation bodies as needed. PT samples are introduced into the regular sample stream of the laboratory and analyzed as routine samples by analysts who regularly perform the method. Laboratory personnel follow all instructions provided by the PT provider.

The Laboratory Director, Technical Managers or the Quality Assurance Manager can institute the analysis of additional PT samples or modify the performance evaluation program as appropriate.

The following guidelines are followed by ALS:

- Averaging results is prohibited.
- Only qualified ALS laboratory employees analyze PT samples.
- Results are not discussed with outside entities or other ALS laboratories prior to the deadline for receipt of the results.
- ALS does not subcontract to other laboratories or receive from other laboratories any PT samples.

When a PT sample result is scored as “Not Acceptable”, an NCAR is issued by the QA Manager, as per ADM-NCAR, to initiate corrective action to determine and correct any problem(s) leading to the unacceptable result.

Participation in Proficiency Testing programs provides the laboratory with evidence of correlation of results with other laboratories and national standards. A four year proficiency testing schedule is maintained by the QA Manager as required by the DoD QSM.

When no commercial Proficiency Testing (PT) sample is available for an analyte that is routinely reported by ALS to a client, the QA Department will use demonstration of capabilities (DOCs) to monitor and evaluate the precision and accuracy of the analytical procedure against defined acceptance criteria documented in the Standard Operating Procedure.

Tracking and Evaluation of Accuracy and Precision

When evaluating batch QC the analyst makes a sequence of decisions before reporting sample results regarding calibration, the method blank, LCS, surrogate recovery, matrix spike, and matrix spike duplicate recovery results.

Assessment of the accuracy of an analytical measurement is based upon the analysis of samples of known composition. ALS relies upon the analysis of LCS/QC samples to track accuracy. The percent recovery relative to the expected value is calculated and can be plotted.

Assessment of the precision (repeatability) of an analytical measurement is based upon repeated analysis of equivalent samples of known or unknown composition. ALS relies upon the analysis of pairs of LCS/QC samples, duplicate samples, or spiked matrix samples (MS/MSD) to assess precision. The range of the pair is expressed as a relative percent difference (RPD).

Control limits for the accuracy and precision of each method are included in the analytical SOPs, and are based on set limits as indicated by the client (project specific), in the reference method or program, or as calculated using in-house data, Control limits for accuracy and precision charts are calculated assuming a normal (Gaussian) distribution of results. Historical data points are used to calculate mean values, two-standard deviation warning limits, and three-standard deviation control limits. The establishment and updating of control limits is described in SOP *Trending, Control Charts, and Uncertainty* (ADM-TREND).

Trending

In addition to evaluating individual batch QC results against control limits, QC results from successive batches are also evaluated for possible trends. While a trend is not necessarily an out-of-control situation in itself, it can provide an early warning of a condition that can cause the system to go out of control. SOP *Trending, Control Charts, and Uncertainty* (ADM-TREND) describes in detail the assessment of QC data in the laboratory. The following conditions are trends that may initiate action and/or monitoring.

- A series of successive points on the same side of the mean.
- A series of successive points going in the same direction.
- Two successive points between warning limits and control limits.

ALS relies on analytical staff to identify trends in analytical systems. Quality Assurance can produce control charts as needed to assess trends but this activity by QA is not preventive and is only used to verify trends exist. The occurrence of a trend does not invalidate data that are otherwise in control. However, trends do require attention to determine whether a cause can be assigned to the trend so that appropriate preventive action can be undertaken.

Long term trends in control limits are evaluated quarterly and annually by quality assurance and technical operations. See SOP *Trending, Control Charts, and Uncertainty* (ADM-TREND).

7.6 Reporting of Results

ALS relies upon a system of peer review to ensure the quality of analytical reports. Peer review procedures are specified in the SOP *Laboratory Data Review Process* (ADM-DREV). An analyst, familiar with the analytical method used to produce the results (peer reviewer), reviews each report. The peer reviewer verifies that the calibration standards, type of calibration, and sample set with associated QC samples were selected correctly. The peer reviewer also verifies any manual transcriptions and calculations. The applicable Technical Manager can perform additional technical review.

Project Managers perform an initial review of results for large projects to verify that data reports submitted to the client meet all project and client requirements.

When the peer review has been completed, a final report is generated. In most situations the report is produced from LIMS. In some cases part or all of the report can be produced from the data system of the analytical instrument. The reports produced by ALS meet the following requirements:

- The report identifies the method used. If the method is modified, it is noted as “modified” in the report.
- Any abnormal sample conditions, deviation from hold time, irregularities in preservation or other situations that might affect the analytical results are noted in the report and associated with the analytical results.

The contents of the report include:

- The report title with the name, address, and telephone number of the laboratory.
- The name of the client or project and the client identification number.
- Sample description and laboratory identification number.
- The dates of sample collection, sample receipt, sample preparation, and analysis.
- The time of sample preparation and/or analysis if the required hold time for either activity is 48 hours or less.
- A method identifier for each method, including methods for preparation steps.
- The MDL or minimum reporting limit for the analytical results.
- The analytical results with qualifiers as required.
- A description of any quality control failures and deviations from the accepted method.
- The name (electronic signature) and title of the individual(s) who accept responsibility for the content of the report.
- The date the report is issued.
- Clear identification of any results generated by a subcontract laboratory.
- Page numbers and total number of pages.
- Electronic Data Deliverables (EDDs) can be developed and generated per client or agency specific specifications, and may contain a subset of components included on the final report. See SOP Report Generation (ADM-RG).

ALS does not evaluate or interpret results.

ALS does not perform calibration services.

Sampling activities are not performed by ALS.

The laboratory reports results based on the sample provided by the customer. If ALS reports to a specification it is only for the sample results and not involved with decision rules applied to the sampling site.

ALS does not make any statements concerning opinions and interpretation of results.

Amended reports of analytical results are issued to correct errors. Amended reports require the following items:

Amendments to analytical reports will only be made in supplemental documents and shall contain identification similar to "Amended".

Include the date amended or released to the client.

Amended reports shall meet all reporting and client requirements.

Amended Reports are stored with the original report, are uniquely identified, and make reference to original reports.

A peer review process is used to ensure amended results are accurate.

Any information changed in the report must have the reason for the change documented in the report.

7.7 Complaints

ALS has a documented process for how complaints are received and evaluated. Nonconformance or corrective actions are generated to ensure decisions and outcomes are monitored and communicated. These outcomes are reviewed by the Quality Assurance department. The SOP on handling complaints is SOP *Handling Customer Feedback* (ADM-FDBK).

7.8 Nonconforming Work

The ALS SOP for handling nonconformance is SOP *Nonconformance and Corrective Action Procedures* (ADM-NCAR).

This laboratory procedure shall be implemented when any aspect of its laboratory activities or results of this work do not conform to its own procedures or the agreed requirements of the customer. The procedure ensures that:

- The responsibilities and authorities for the management of nonconforming work are defined;
- Actions (including halting or repeating of work and withholding of reports, as necessary) are based upon the risk levels established by the laboratory.
- Any employee may stop work when a task cannot be performed safely or the quality of data is determined to be or could be negatively affected. Metrics utilized for work stoppage may include but are not limited to exceeding instrument or sample control limits, QC trending, instrument problems, etc. The appropriate manager shall be consulted for any work stoppage;
- An evaluation is made of the significance of the nonconforming work, including an impact analysis on previous results;
- A decision is taken on the acceptability of the nonconforming work;
- Where necessary, the customer is notified and work is recalled;
- The responsibility for authorizing the resumption of work is defined.

The laboratory retains records on all nonconformance.

Quality Assurance Manager or designee reviews all nonconformance for completeness and adds comments as necessary on the acceptance. If this evaluation determines the problem has or can reoccur or it is against the laboratories own policies or procedures the event requires a corrective action as described in section 8.7.

7.9 Control of Data and Information Management

The laboratory has access to all data and information through the internet, intranet, network locations and hard copy.

7.9.1 All of the software used for data reduction, verification, and reporting is documented and validated by the ALS computer support staff or by the vendor from whom it is purchased. ALS software is controlled and secured according to SOP *Software Quality Assurance and Data Security* (ADM-SWQADATA). A continuing effort is made at ALS to increase the use of automated data handling, improve efficiency, and minimize human error.

Software errors are treated as a nonconformance under section 7.10 or as a corrective action under 8.7.

7.9.2 Access to ALS networks are controlled through passwords and windows security. Network drives are backed up and disaster planning is evident.

7.9.3 ALS uses offsite locations from the laboratory but internal to ALS for data storage and is managed in accordance with these procedures.

7.9.4 Access to network locations is managed with windows security and roles throughout the system.

7.9.5 Calculations and data transfers are checked using the peer review process and through documentation of computer programs by the IT staff.

8. Management System Requirements

8.1 Options

8.1.1 The laboratory has implemented **Option A** from the ISO/IEC 17025:2017 standard as a management system. The following sections 8.2 through 8.9 address the required elements of Option A. This manual addresses management systems and demonstrates compliance with this document.

8.2 Management System Documentation

8.2.1 This manual describes the policies and objectives of the ALS management system. The laboratory procedures describe the details on how objectives are accomplished.

8.2.2 Policies and objectives of the management system address how competence is demonstrated and assessed, how testing is objectively reviewed and how consistent operations are accomplished. These are addressed in various procedures that define the processes used.

8.2.3 Evidence of commitment is the review of the manual annually and the records of reading by all employees. Additionally, employees are assigned pertinent procedures as needed to ensure objectivity and consistency.

8.2.4 The policies are supported in this management system with references to the procedures as appropriate.

8.2.5 All employees have access to the Quality Assurance Manual and the supporting procedures.

8.3 Control of Management System Documents

8.3.1 SOPs and the QAM are maintained under document control procedures described in SOP *Document Control* (ADM-DOC_CTRL). External documents, such as reference methods, accreditation policies and requirements, and reference manuals are maintained under document control policies through the use of hardcopy and network drives. Additionally, quality assurance program documents, project plan documents, and contractual Statement of Work documents generated by a client can be designated as controlled documents at the discretion of the ALS Project Manager, Quality Assurance Manager, or the Laboratory Director.

8.3.2 Revisions are made to uniquely identified internal documents in accordance with SOP *Document Control* (ADM-DOC_CTRL) and the following table. Assignments are made to the responsible ALS manager or designee to review and update SOPs applicable to the area of responsibility. At times it is also necessary to obtain approval by specific clients before written SOPs can be modified. After revision, the appropriate Manager, Quality Assurance Manager, and Laboratory Director must approve the updated SOP. Updated SOPs are then distributed on-line by the Kelso network. All obsolete copies are removed from access and stored for historical purposes.

SOP Type	Review Cycle
Environmental Testing SOPs (DoD)	12 Months
Environmental Testing SOPs (TNI ONLY)	24 Months
Management Systems SOPs	36 Months
All other SOPs	24 Months

8.4 Control of Records

8.4.1 ALS maintains records on the most part electronically and in accordance with SOP *Records Management* (ADM-RCRDS). ALS personnel are responsible for retention, retrieval, and disposition of final records of laboratory data and activities. This includes: data packages, laboratory notebooks, instrument maintenance logs, and training records.

8.5 Data Packages

8.5.1 All documentation which pertains to the analysis of a sample or group of samples that are being reported together must be compiled as a data package.

8.5.2 Electronic records or scans of records that relate to the analysis of field samples are compiled into folders on network drives for storage. These data packages are stored electronically as per SOP *Records Management* (ADM-RCRDS). Unless specified by contract, applicable statute, or program, data packages are retained for ten years.

8.5.3 Laboratory Notebooks and Logbooks

Laboratory notebooks and logbooks are retained by ALS for twelve years and are not released to clients. Laboratory notebooks are assigned to specific analysts, who are responsible for their maintenance. If corrections are required, a single-line cross-out, initials and date are entered.

8.6 **Quality Assurance Records**

8.6.1 Quality control sample results data are retained in LIMS. Records of internal audits, nonconformance reports, and corrective action reports are retained and stored electronically for an indefinite period on networked drives.

8.6.2 The Quality Assurance Manager is responsible for maintaining and retrieving all records of audits, proficiency testing results, demonstration of competency, nonconformance and corrective action records and reports.

Client-Related Information

8.6.3 Project Managers are responsible for maintaining, archiving, and retrieving all contracts, project requirements and QAPPs provided to ALS by clients and related to projects completed by ALS. They are also responsible for the destruction of materials provided on unsuccessful proposals and bidding opportunities. Specific procedures for client communication and required documentation are listed in the SOP *Project Management* (ADM-PCM).

8.7 Actions to Address Risks and Opportunities

8.7.1 ALS views risk management as a key component of its corporate governance responsibilities and an essential process in achieving and mandating a viable organization. ALS is committed to enterprise wide risk management to ensure its corporate governance responsibilities are met and its strategic goals are realized.

8.7.2 Refer to ALS Limited Risk Management Policy and Framework CAR-GL-GRP-POL-007 and Risk Appetite and Tolerance Statement CAR-GL-POL-011 for details.

8.7.3 Risk is defined at ALS as the effect of uncertainty on objectives. Objectives for the organization have different attributes and aspects, such as financial, service, quality, health & safety, environmental stewardship, and are considered at different levels, such as enterprise-wide, operational, and project levels. ALS interprets risk as anything that could impact meeting its corporate strategic objectives, and believes risks can provide positive opportunities as well as having negative impacts.

8.7.4 Tools for evaluating and managing risk include routine procedures such as employee evaluations, control limits trending, RLVS data evaluation, corrective action reports, nonconforming events, SOP review, internal and external audits, and PT results.

8.7.5 Risk reporting mechanisms vary from routine reporting mechanisms and immediate action for lower risk situations to immediate notification of the ALS CEO in extreme cases.

8.7.6 Regardless of the mechanism used, the policies and tools provide a framework for categorizing, assessing, analyzing, and addressing risk, as well as monitoring and reviewing actions taken. Roles and responsibilities are defined in the relevant procedures.

8.7.7 Risk severity is evaluated during the decision making process. For each risk there is an opportunity.

8.8 Risks to our business and how we address them include:

Chemical Exposure

8.8.1 Failure to practice procedures as trained, issues with the facility, and poor engineering controls can result in injury to employees, lost time, med/hospital situation, contamination, and can close the site.

8.8.2 We have policies, chemical exposure training, and readily available SDS sheets. Employees are expected to offer suggestions for improvement and formally report any conditions where concern for safety is recognized.

8.9 Explosion/Chemical Fire

8.9.1 Improper chemical storage and usage along with lack of equipment and facility upkeep can result in loss of life, loss of property, and laboratory down time.

8.9.2 We perform inspections and training, keep an inventory of chemicals, establish storage locations, and maintain minimal quantities of chemicals.

8.10 Supply Disruption

8.10.1 Natural disaster and vendors unable to provide needed supplies can disrupt the business, increase expenses, and result in lost production and lost clients.

8.10.2 We maintain multiple sources for supplies, develop relationships with our vendors, and emphasize communication between analysts, managers, purchasing and vendors.

8.11 Loss of Key Employees

8.11.1 Resignation, leave for personal reasons or for other employment can negatively impact the business.

8.11.2 Communication, cross-training, designated backups, and having a pool of potential replacements minimizes this risk. We provide a positive atmosphere for employees and provide small perks to reward dedication.

8.12 Computer and Instrument Issues

8.12.1 Computer, instrument, or other IT failures can result in loss of revenue, loss of service, and loss of data.

8.12.2 We provide necessary IT resources for instruments and computers including replacing older computers, keeping related systems in good repair, and replacing when necessary. We continue to build robust data systems and make provisions for stellar back-up storage for all data.

8.13 Reputation

8.13.1 Falsifying test results can result in loss of credibility, loss of clients, loss of revenue, and suspension.

8.13.2 All new employees must sign an ethics agreement and have initial ethics and data integrity training. Annually, all employees must take ethics and data integrity refresher training. All data undergoes a proper peer review. We maintain a strong quality system.

8.14 Legal Ramifications

8.14.1 Not following workplace and environmental laws and failure to practice procedures as trained can result in license revocation, fines, and disruption of the business.

8.14.2 Targeted and ongoing training, inspections, and having established procedures minimizes this risk. We continue to follow all laws and regulations.

8.15 Loss Time Injury

8.15.1 Failure to practice procedures as trained and not having proper safeguards in place can result in injury to employees, lost time, med/hospital situation, contamination, and can close the site.

8.15.2 Policies, specific task related training, targeted and ongoing training, inspections, workplace safeguards, cross training, and designated backups, minimize this risk. We continue to grow the safety program and culture.

8.16 Loss of Revenue

8.16.1 Can be caused by various audit fines and contract penalties for late data resulting in loss of revenue and disruption in business.

8.16.2 Policies, specific quality training, targeted and ongoing training, inspections, workplace safeguards, and internal audits minimize this risk. We continue to perform lab operations at the highest level.

8.17 Improvement

8.17.1 ALS management is committed to continually improving the effectiveness of the management and quality systems by implementing the requirements of this quality manual. ALS is also committed to improvements of the management systems through compliance with its own policies and procedures. ALS management is also committed to compliance with requirements related to current EPA CLP SOWs, DoD/DOE QSM, and other client and project related requirements. Internally ALS maintains a process improvement website for employees to provide suggestions for improvements.

8.17.2 ALS surveys clients and gains feedback on services provided. This input to management is managed at a corporate level and is reviewed monthly and during the management review processes.

8.18 Corrective Actions

8.18.1 ALS Laboratory operations are governed by documented procedures, requirements, quality assurance plans, project plans, and contracts. When any operation, for any reason, does not conform to the requirements of the governing documents, the aberrant event, item, or situation must be properly documented and evaluated. In addition, appropriate corrective action must be initiated. Procedures for the documentation and resolution of corrective action are detailed in the SOP *Nonconformance and Corrective Action Procedures* (ADM-NCAR). It is the policy of ALS that any corrective action which impacts results of testing must include notification to clients.

8.19 Internal Audits

8.19.1 Internal audits are conducted in accordance with SOP *Internal Audits* (ADM-AUDIT). When internal and external audits or data assessments reveal a cause for concern with the quality of the data an investigation is initiated by quality assurance personnel to determine the extent of the problem. Internal audits include examination of laboratory practice, the use of data handling systems, documentation and document control, personnel qualification and training records, procurement activities, and other systems that support and augment the laboratory analytical function. All audit findings and any event that casts doubt on the validity of the testing results requires corrective action and client notification within two weeks.

8.20 Management Review

8.20.1 Review of the Management System is completed on an ongoing basis in accordance with SOP *Lab Management Review* (ADM-LABMGMT).

8.20.2 Inputs to management reviews may be kept in agenda notes and include but are not limited to:

a) Changes in internal and external issues that are relevant to the laboratory;

b) Fulfilment of objectives;

c) Suitability of policies and procedures;

d) Status of actions from previous management reviews;

e) Outcome of recent internal audits;

f) Corrective actions;

g) Assessments by external bodies;

h) Changes in the volume and type of the work or in the range of laboratory activities;

i) Customer and personnel feedback;

j) Complaints;

k) Effectiveness of any implemented improvements;

l) Adequacy of resources;

m) Results of risk and opportunity identification;

n) Outcome of the assurance of the validity of results; and

o) Other relevant factors, such as monitoring activities and training.

8.20.3 The outputs from the management review shall record all decisions and actions related to at least:

a) The effectiveness of the management system and its processes;

b) Improvement of the laboratory activities related to the fulfilment of the requirements of this document;

c) Provision of required resources;

d) Any need for change.

A summary of these outputs is generated annually.

9. Change History

Revision Number	Effective Date	Document Editor	Description of Changes
29.0	7/16/2021	K. Clarkson	Updated QAM signatories, Organizational Charts and Key Personnel.

10. Appendices

The documents listed in this section are dynamic; accordingly they can change without notice or revision to this QAM. Appendices are current as of the effective date of this SOP. Please contact the laboratory for the most current documents.

APPENDIX A – Data Quality Objectives and Definitions

APPENDIX B –Organization Charts and Key Personnel

APPENDIX C – Ethics and Data Integrity Agreement

APPENDIX D – Laboratory Floor Plan

APPENDIX E – Analytical & Support Equipment

APPENDIX F – Sample Preservation, Containers, and Hold Times

APPENDIX G – Standard Operating Procedures

APPENDIX H – Data Qualifiers

APPENDIX I – Master List of Controlled Documents

APPENDIX J – Laboratory Accreditations

APPENDIX K – Chain of Custody and Cooler Receipt Forms

Appendix A
Data Quality Objectives and Definitions

Data Quality Objectives

The data quality objectives discussed below ensure that data will be gathered and presented in accordance with procedures appropriate for its intended uses, and that the data will be of known and documented quality able to withstand scientific and legal scrutiny. The quality of the measurement data can be defined in terms of completeness, accuracy, precision and traceability.

Completeness - Completeness is defined as the percentage of measurements that are judged to be valid measurements. Factors negatively affecting completeness include the following: sample leakage or breakage in transit or during handling, missed method prescribed holding times, lost sample during laboratory analysis through accident or improper handling, improper documentation such that traceability is compromised, or rejection of sample results due to failure to conform to QC criteria specifications.

Accuracy - Accuracy is the measure of agreement between an analytical result and its "true" or accepted value. Deviations from a standard value represent a change in the measurement system. Potential sources of deviations include (but are not limited to) the sampling process, sample preservation, sample handling, matrix effects, sample analysis and data reduction. Sampling accuracy is typically assessed by collecting and analyzing field and trip blanks for the parameters of interest. Analytical laboratory accuracy is determined by comparing results from the analysis of laboratory control samples or check standards to their known values. Accuracy results are generally expressed as percent recovery.

Precision - Precision is the determination of the reproducibility of measurements under a given set of conditions, or a quantitative measure of the variability of a group of measurements compared to their average value. Precision is typically measured by analyzing field duplicates and laboratory duplicates (sample duplicate, matrix spike duplicate, check standard duplicate and/or laboratory duplicate). Precision is most frequently expressed as standard deviation, percent relative standard deviation or relative percent difference.

Traceability - Traceability is the extent to which reported analytical results can be substantiated by supporting documentation. Traceability documentation exists in two essential forms: those which link the quantitation process to authoritative standards and those which explicitly describe the history of each sample from collection to analysis and disposal.

Laboratory Quality Control Definitions

Technical personnel are responsible for complying with all quality assurance/quality control requirements that pertain to their technical functions. ALS uses the following internal quality controls to verify that the data produced by the laboratory has the required degree of accuracy and precision and is free from contamination due to laboratory processes. All samples are normally processed in preparation and analytical batches of no more than 20 samples per batch. The following quality control checks defined below are appropriate for the various methods performed in the laboratory. Individual SOPs will further define the specific checks to be analyzed with each method. Additionally, a Customer's individual Quality Assurance Project Manual may require the laboratory to include additional checks for analysis depending on the *site* requirements.

Method Blank - A method blank is an analytical control consisting of all reagents, internal standards, and surrogate standards that is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and reagent contamination contributed from the preparation or processing of the sample.

Reagent Blank - A reagent blank is an analyte-free sample that contains all the reagents used in a particular method. It is prepared and analyzed to determine if contamination is present at detectable levels that can be attributed to the reagents used in the process.

Field Blank - A field blank consists of reagent water that is transported to the sampling site, transferred from one vessel to another at the site, and preserved with the appropriate reagents. This serves as a check on reagent and environmental contamination.

Trip Blank - A trip blank consists of reagent water that is transported to the sampling site and returned to the laboratory without being opened. This serves as a check on sample contamination originating from sample transport, shipping, and from the site conditions. The holding time for the trip blank begins when received by the laboratory, unless otherwise specified by the client, such as the time when field samples were collected.

Refrigerator / Storage Blank - Refrigerator/storage blanks are placed in VOA refrigerators on a weekly basis and analyzed by GC/MS for the full Volatile Organic Analytes/Target Compound List (VOA-TCL). These blanks are used to monitor the volatile storage refrigerators for the presence of sample cross-contamination. In order to maintain continuous measurement within each refrigerator these blanks are prepared and logged into the Laboratory Information Management System (LIMS) by the Sample Custodian for specific turnaround times. This ensures that at least one blank is present in each volatile refrigerator at all times. If contamination is found the analyst is required to take corrective action to prevent the problem from affecting other stored samples. All samples associated with a positive blank will then be qualified on the analytical report. The QC Department reviews these results and maintains these files for review by regulatory agencies for a period of 10 years.

Quality Control Reference Sample or Calibration Verification Standard (Second Source Standard) - A QC reference sample is a sample prepared from a source other than that used for calibration at a concentration within the calibration range. It is used to verify that the calibration standards were prepared accurately. It is analyzed after every initial calibration performed in the laboratory.

Laboratory Control Sample (LCS/LFB) - A Laboratory Control Sample (aka Laboratory Fortified Blank) is a laboratory blank fortified at a known concentration. Aqueous and solid LCSs are analyzed using the same sample preparation, reagents, and analytical methods employed for the samples. An LCS is analyzed with each preparative or analytical batch as required by the method. It provides a measure of the accuracy of the analytical system in the absence of matrix effects.

Surrogate Standards - Surrogates are organic compounds which are similar to analytes of interest in chemical composition, extraction, and chromatography, but which are not normally found in environmental samples. These compounds are spiked into all blanks, calibration and check standards, samples (including duplicates and QC reference samples), and spiked samples prior to an organic analysis. Percent recoveries are calculated for each surrogate to detect problems in the sample preparation process and monitor the efficiency of the process.

Duplicate - A duplicate is a second aliquot of a sample that is prepared and analyzed in the same manner as the original sample in order to determine the precision of the method. Samples selected for duplicate analysis are rotated among Customer samples so that various matrix problems may be noted and/or addressed. Poor precision in a sample duplicate may indicate a problem with the sample composition and shall be reported to the Customer whose sample was used for the duplicate analysis.

Matrix Spike/Matrix Spike Duplicate - A matrix spike/matrix spike duplicate is the addition of a known amount of a target analyte to a sample that is subjected to the entire analytical procedure. Samples selected for matrix spiking are rotated among Customer samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the Customer whose sample was used for the spike.

Method Detection Limit (MDL) - The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Reportable Detection Limit (RDL) - The reportable detection limit on the laboratory report is a concentration at which the laboratory routinely reports results. The RDL may also be the method detection limit and is based on whether the Customer requires the result reported down to the MDL. It is laboratory policy to indicate on the laboratory report when the method detection limit is used as the RDL.

Common Laboratory Contaminants - Some common laboratory contaminants include: methylene chloride, acetone, 2-Butanone, hexane, phthalates, aluminum, and zinc. These analytes are sometimes seen in laboratory blanks due to their use in the processing of samples. When blank contamination occurs it is required that samples associated with these blanks be reprocessed. However, if reprocessing cannot occur due to lack of sample, holding time issues, or Customer turnaround time a comment will be placed on the analytical report defining the problem.

Internal Standard (IS) - A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method (NELAP).

Minimum Reporting Level (MRL) - Minimum Reporting Levels represent an estimate of the lowest concentration of a compound that can be quantitatively measured by a group of experienced drinking water laboratories.

Detection Limit (DL) for DoD - The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

Limit of Detection (LOD) for DoD - The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

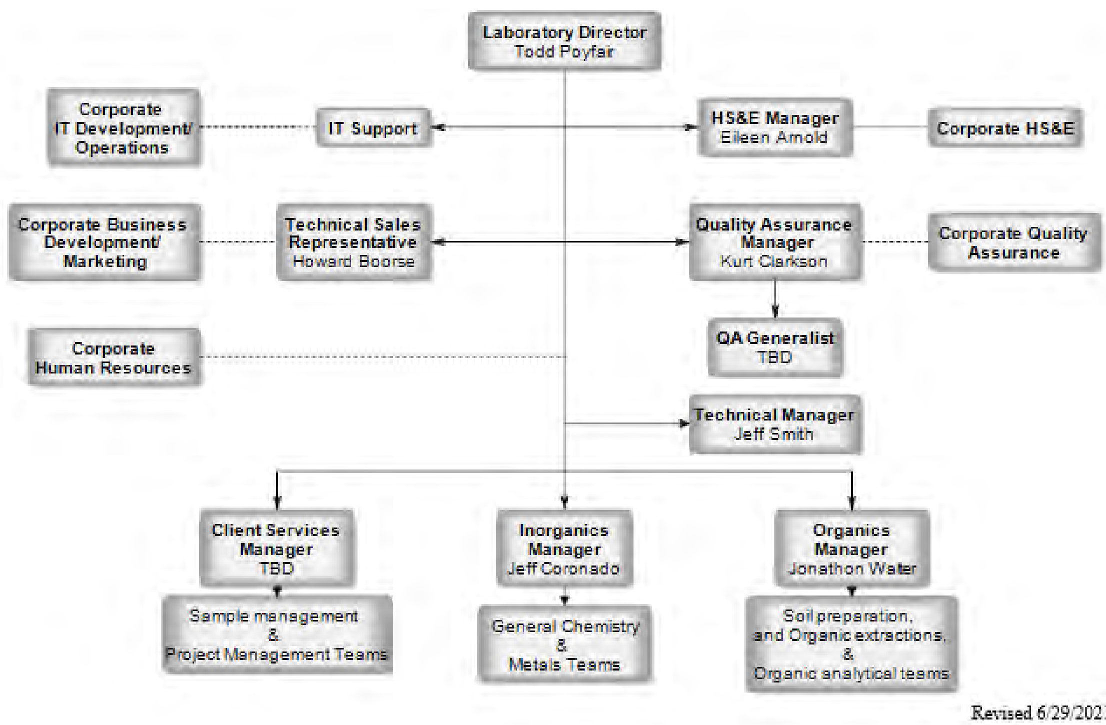
Limit of Quantitation (LOQ) for DoD - The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

Holding Times - Samples are prepared and analyzed within method prescribed holding times per SOP 19-Sample Preservation Protocol and the appropriate method SOP. Holding time is the time from sampling until the start of analysis unless otherwise specified by a project QAPP. The date and time of sampling documented on the chain of custody establishes the time zero. If the holding time is specified to be measured in hours, then each hour is measured from the minute the sample was collected in 60-minute intervals. When the maximum allowable holding time is expressed in days, the holding time is based on calendar day measured from time zero, the date the sample was collected. The first day of holding time is not passed until midnight of the day after the sample was collected. Holding times for analysis include any necessary re-analysis due to instrument failure or analyst error that does not yield useful data. If sample re-analysis is necessary due to sample matrix, such as a dilution or matrix spike failure due to matrix interference, the holding time still applies. A comment is added to the final report stating that further analysis was required past hold time. The sampling time must be documented on the chain of custody form by the Customer.

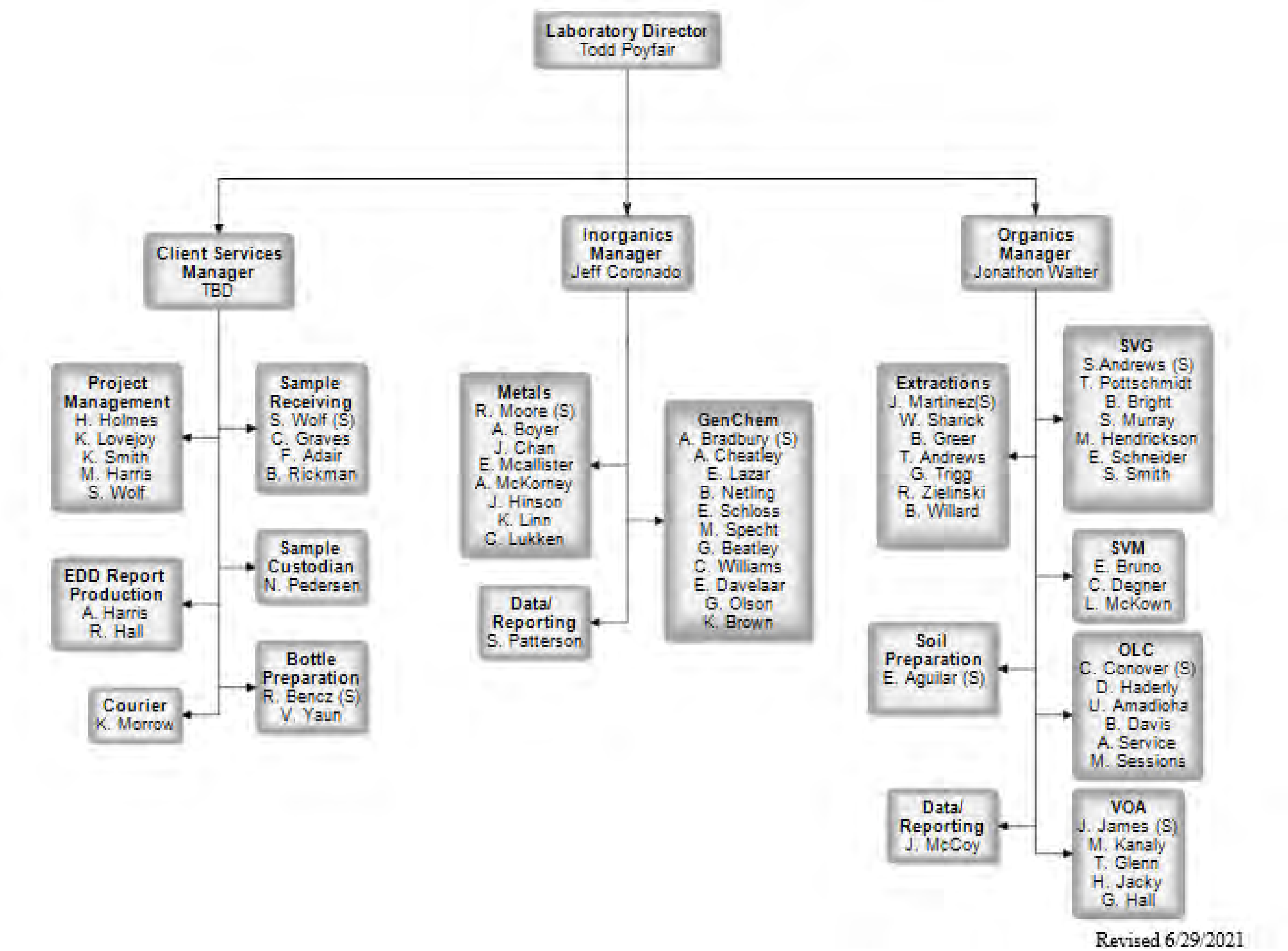
Turn Around Time - Turnaround time is the time from receipt of samples to the transmittal of analytical data by mail, electronically or facsimile. The day the chain-of-custody is signed by the sample custodian is day zero in the turnaround time. Samples results will be due by the close of business on the last day of the turnaround time unless alternate arrangements have been made with the laboratory. The turnaround time is based on working business days, excluding weekends and holidays.

Appendix B
Organizational Charts and Key Personnel

Kelso, WA Laboratory
Organizational Chart
June 29, 2021



Kelso, WA Laboratory
Organizational Chart
June 29, 2021



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TODD POYFAIR

Laboratory Director, 2021 - Present
Kelso Laboratory

Responsible for all phases of laboratory operations at the Kelso Laboratory, including project planning, budgeting and quality assurance. Primary duties include the direct management and operational oversight of the Kelso laboratory and all department managers.

PREVIOUS EXPERIENCE

Client Services Manager2020 - 2021
Kelso Laboratory
Management of the Client Services Departments: Project Management, Electronic Data Deliverables & Report Production, Sample Management, Sample Control, Bottle Preparation, General Lab Receiving & Shipping, and Courier Services.

Organics Manager, 2017 - 2020
Kelso Laboratory
Oversee the operation of the Volatiles, Semi-volatiles, and OLC laboratories. Responsibilities included organizing and prioritizing workload, training and development of staff, working with PMs on client-specific project requirements, workload coordination, method development efforts and resource allocation.

Technical Scientific and Business Development Representative, 2012-2017
ALS Group USA, Corp.
Kelso, WA

Corporate IT Director / Vice President 2010-2012
Kelso, WA
Columbia Analytical Services
Phoenix, AZ

Laboratory Director / Vice President 2008-2010
Columbia Analytical Services
Phoenix, AZ
Responsible for all phases of laboratory operations at the Phoenix and Tucson Laboratories, including project planning, budgeting and quality assurance. Primary duties include the direct management and operational oversight of the Kelso laboratory and all department managers.

Department Manager 1993-2009
Columbia Analytical Services
Kelso, WA

EDUCATION

Portland State University
BS Chemistry
BA Foreign Language/German
1990/1991

ADDITIONAL EXPERIENCE

Laboratory Manager
04/1993 – 09/2008
Columbia Analytical Services, Kelso, WA

Chemist, Project Manager
08/1991 – 09/2008
Columbia Analytical Services, Kelso, WA

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Kurt Clarkson

QA Manager 2020 - Present
ALS-Kelso

Responsible for maintaining the quality systems and ensuring data integrity standards are implemented for the Kelso Laboratory. This includes upholding the requirements of analytical certifications, maintaining QA documents (QA Manual, SOPs, and QA records), coordinating PE/PT testing, conducting internal audits, and acting as a primary point of contact for external audits.

Additional current responsibilities: Safety Committee member, 2017-Present

Previous Experience

Senior Project Manager, 2017-2020
ALS Environmental, Kelso
Kelso, WA
Responsible for technical project management, ensuring overall data quality and compliance with customer requirements. Provide technical support to clients regarding laboratory application to projects including regulatory interpretation assistance, as well as project organization of work.

Additional positions held at ALS-Kelso:
Client Services Manager, 2016-2017
Project Manager 2, 2015-2016

Positions held prior to ALS Environmental, Kelso:
Client Services Manager, 2013-2015
Western Environmental Testing Laboratory
Sparks, Nevada

Client Services Manager, 2012-2013
STAT Analysis
Chicago, IL

Project Manager/Chemist Analyst, 2008-2011
SGS
Anchorage, AK

EDUCATION

Walden University – Minneapolis, MN
Doctorate in Business Administration (candidate)
-graduation date 2022

University of Alaska Anchorage – Anchorage, AK
Master's in Business Administration - MBA
2011

University of Nevada Reno – Reno, NV
Bachelors in Biology
2007

University of Nevada Reno – Reno, NV
Bachelors in Business
2002

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JEFF CORONADO

Manager - Specialty Laboratory Area, Metals Department Manager, 1992 - Present, General Chemistry Department Manager, 2017 - Present, Kelso Laboratory

Management of the Kelso General Chemistry and Metals Departments with a staff of 28 and annual revenues in excess of $5 million. Responsible for data quality and timeliness, revenues, expenses, workload coordination, method development efforts, and resource allocation. Participation in multiple LIMS development teams responsible for defining the ALS product.

PREVIOUS EXPERIENCE

Supervisor, GFAA Laboratory, 1989-1992
Columbia Analytical Services, Inc.
Kelso, WA

Responsibilities included supervision of metals analysis by graphite furnace atomic absorption following SW 846 and EPA CLP methodologies. Duties include workload scheduling, data review, instrument maintenance, personnel training and evaluation.

EDUCATION

Western Washington University - Bellingham, WA
BS Chemistry
1988

Western Washington University - Bellingham, WA
BA Business Administration
1985

Winter Conference on Plasma Spectrochemistry - Tucson, AZ, 2012

LC/ICP-MS Training Course - PerkinElmer, 2008

Field Immunaossay Training Course - EnSys Inc., 1995

Winter Conference on Plasma Spectrochemistry - San Diego, CA, 1994

ICP-MS Training Course - VG-Elemental, 1992

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Jonathon Walter

Organics Manager
ALS Environmental, Kelso Laboratory
Mar 2020 - Present

Responsible for directing the organic sample preparation teams and organic instrumentation teams. Responsible for ensuring that ALS quality systems and data integrity standards are followed. Manage workflow for departments ensuring client needs are met and working with PCs on special projects. Responsible for development of employees, method development efforts, quality and timeliness of data to clients.

PREVIOUS EXPERIENCE

Sample Preparation Manager
ALS Environmental, Kelso Laboratory
June 2018 – Mar 2020

Responsible for directing the sample preparation teams, organic extractions and soil prep. Responsible for ensuring that ALS quality systems and data integrity standards are followed. Manage workflow for departments ensuring client needs are met and working with PCs on special projects. Responsible for development of employees, method development efforts, quality and timeliness of samples to labs.

Laboratory Manager
Analytical Resources, Inc.
Feb 2018 – Jun 2018

Plan and implement the overall laboratory policies, procedures, and services for each division. Ensure efficient and effective departmental operations, as well that departments follow industry standards and safety regulations. Provide input to strategic decisions for the company. Train supervisors in leading their respective sections, including coaching and mentoring supervisors to become better leaders.

Organic Extraction Laboratory Supervisor
Analytical Resources, Inc.
Oct 2016 – Feb 2018

Oversee the preparation of samples for semi-volatile, polynuclear aromatic hydrocarbons, chlorinated pesticides, chlorinated phenols, PCBs, PCB congeners, and extractable petroleum hydrocarbons. Responsible for ensuring deadlines are met, all extraction methods and daily QA/QC practices are upheld, scheduling and training employees, along with maintaining the budget and supplies for the lab section.

GC/GC-MS Analyst/HRGCMS Analyst
Analytical Resources, Inc.
Aug 2012 – Nov 2016

Analyzed TPHG, TPHD, SVOA, VOA, Dioxin by GC, GCMS, HRGCMS. Processed, reported and peer reviewed data for all analysis and performed maintenance as needed on instruments.

Dioxin Laboratory Supervisor and Tech
Analytical Resources, Inc.
Supervisor Aug 2012 – Feb 2018
Tech July 2010-Aug 2012

Oversee workload, interpretation of data, development of new extraction techniques and cleanups. Always ensuring all regulatory requirements are met. Responsible for the extraction and cleanup of solids, tissues and waters for Dioxin and Furan analysis by 1613, 8290, and EPA methods.

EDUCATION

Washington State University
Pullman, WA
BS Chemistry 2008

Eileen M. Arnold

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Environmental

Education

Immaculata College, Immaculata, PA
BA, Chemistry, 1977

Health, Safety and Environmental Manager, Kelso

2020 - Present

While working for the Kelso facility, duties include incident reporting and investigation, maintenance of all safety related equipment, review of monthly safety audits, and completion of all Federal and State mandated EH&S reports.

Previous Experience

ALS
Kelso, WA
Health, Safety and Environmental Manager, Western US, *'15-'20*

Responsibilities include development, support and implementation of Environmental, Health and Safety policies for lab locations in the Western US, including national corporate policies for respiratory protection and hazardous waste generation.

ALS Group/ Columbia Analytical Services , Inc.
Kelso, WA
Scientist IV Metals Laboratory/Kelso Health and Safety Officer, *'94-'15*

Supervisor of the Metals reporting group responsible for ensuring timely, accurate reporting of all metals reports. Responsible for updating instrument specific data, such as MDL and control limits. Analyst for the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques. Also, Environmental, Health and Safety Officer.

Columbia Analytical Services, Inc.
Kelso, WA
Project Chemist, '92-'94

Duties included technical project management and customer service. Responsible for meeting the clients' needs of timely and appropriate analyses, and to act as liaison for all client-related activities within Columbia Analytical Services, Inc.

Columbia Analytical Services, Inc.
Kelso, WA
Scientist IV Metals Laboratory, '87-'92

Duties include the operation and maintenance of the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques.

Dow Corning Corporation.
Springfield, OR
Chemist, '86-'87

Responsibilities included ICP and atomic absorption work in silicon manufacturing. Methods development for ICP analysis of minor impurities found in silicon.

Ametek, Inc.
Harleysville, PA
Chemist, '86-'87

Responsibilities included product research and development chemist involved in production of thin-film semiconductors for use as solar cells. Work involved AA and SEM techniques

Janbridge, Inc.
Philadelphia, PA
Chemist, '78-'82

Responsibilities included maintaining electroplating process lines through wet chemical analysis techniques, and performed Quality Assurance testing on printed circuit boards.

Appendix C
Ethics and Data Integrity Agreement

ETHICS AND DATA INTEGRITY AGREEMENT
ALS Environmental – USA

I state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at ALS.

I agree that in the performance of my duties at ALS:

1. I shall not intentionally report data values that are not the actual values obtained;
2. I shall not intentionally report the dates, times and method citations of data analyses that are not the actual dates, times and method citations of analyses;
3. I shall not intentionally represent another individual's work as my own;
4. I shall not intentionally report data values that do not meet established quality control criteria as set forth in the Method and/or Standard Operating Procedures, or as defined by company policy.
5. I agree to inform ALS of any accidental or intentional reporting of non-authentic data by other employees.
6. I have read this ethics and data integrity agreement and understand that failure to comply with the conditions stated above will result in disciplinary action, up to and including termination.
7. I agree to adhere to the following protocols and principals of ethical conduct in my work at ALS. All work assigned to me will be performed using ALS approved methods and procedures and in compliance with the quality assurance protocols defined in the ALS Quality System.
8. I will not intentionally falsify nor improperly manipulate any sample or QC data in any manner. Furthermore, I will not modify data values unless the modification can be technically justified through a measurable analytical process or method acceptable to ALS. All such modifications and their justification will be clearly and thoroughly documented in the raw data and appropriate laboratory record, and will include my initials or signature and the date.
9. I will not make false statements to, or seek to otherwise deceive ALS staff, managers or clients. I will not knowingly, through acts of commission, omission, erasure or destruction, improperly report any test results or conclusions, be they for client samples, QC samples, or standards.
10. I will not condone any accidental or intentional reporting of unauthentic data by other ALS staff and will immediately report such occurrences to my Supervisor, Lab Director, Quality Assurance Manager, or Human Resources. I understand that failure to report such occurrences may subject me to immediate discipline, including termination.

11. If a supervisor, manager, director or other member of the ALS leadership group requests me to engage in or perform an activity that I feel is compromising data validity or defensibility, I have the right to not comply with the request. I also have the right to appeal this action through an ALS local Quality Staff, Corporate Quality Assurance or Human Resources.

12. I understand that if my job includes supervisory responsibilities, I will not instruct, request or direct any subordinate to perform any unethical or non-defensible laboratory practice. Nor will I discourage, intimidate or inhibit a staff member who may choose to appropriately appeal my supervisory instruction, request or directive that may be perceived to be improper, nor retaliate against those who do so.

13. I understand that employees who report violations of this policy will be kept free from intimidation and recrimination arising from such reporting.

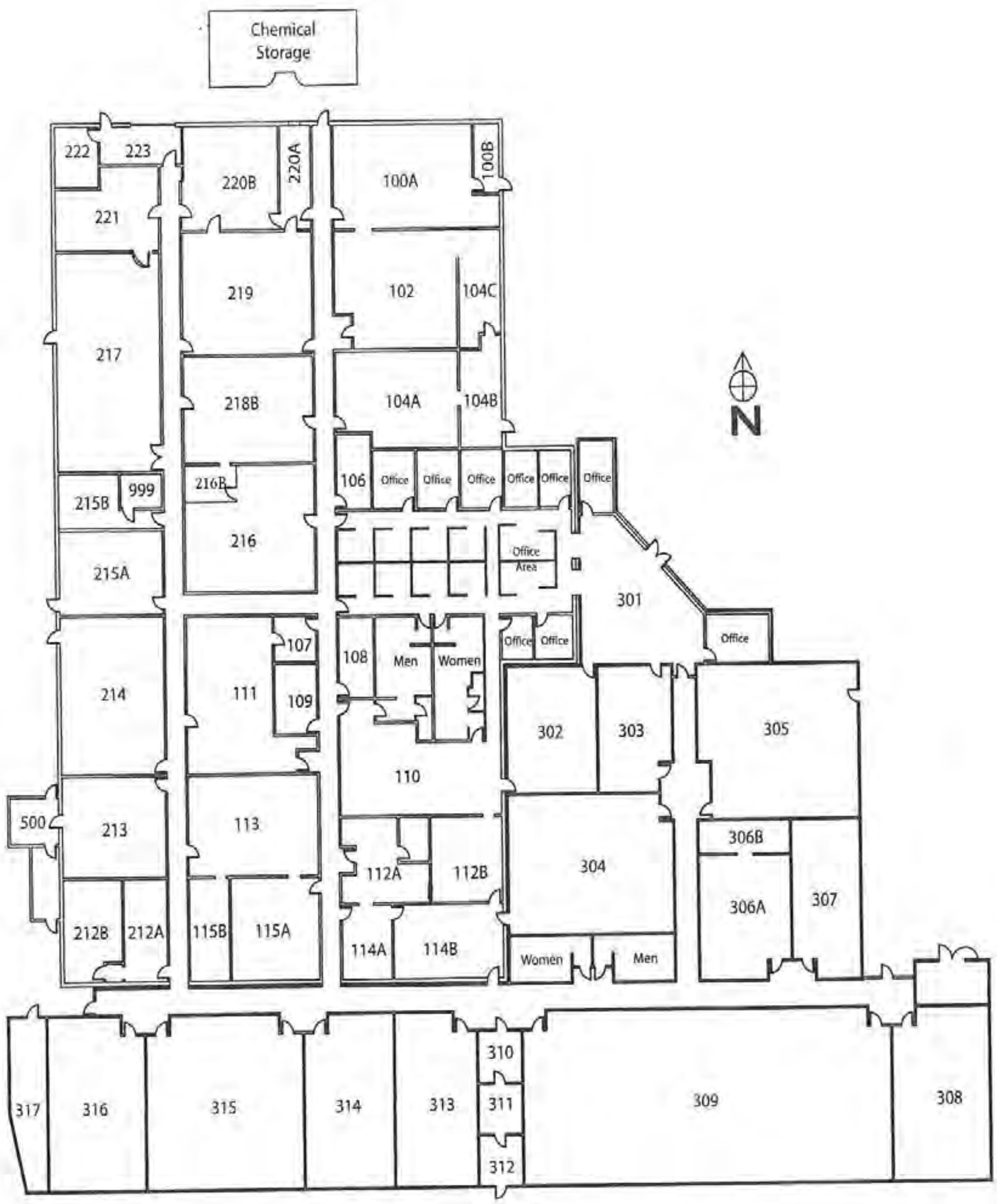
I have read, and understand the above policy and realize that failure to adhere to it may result in disciplinary action, up to and including termination. Compliance with this policy will be strictly enforced with all personnel employed by the company.

Employee Name ___________________________ Signature ___________________________

ALS Location___________________________ Date ___________________________

Appendix D
Laboratory Floor Plan

100A	SVO-GC INSTRUMENT LAB
100B	ELECTRICAL ROOM
102A	SVO-GC OFFICE
104A	VOA
104B	SVG/SVM OFFICE
104C	SVO-GC INSTRUMENT
106	DI WATER ROOM
107	OVEN ROOM
108	TCLP LAB
109	STOCK ROOM/ SAFETY SUPPLY
111	GENERAL CHEMISTRY LAB
110	LUNCHROOM
112A	GENERAL CHEMISTRY LAB
112B	COPY CENTER
113	METALS / ICP-MS LAB
114A	GRAIN SIZE LAB
114B	TOTAL SOLIDS/PREP LAB
115A	METALS / ICP-OES LAB
115B	METALS OFFICE
212A	METALS / HYDRIDE, MERCURY
212B	LOW LEVEL MERCURY LAB
213A	GENERAL CHEMISTRY LAB
214	GENERAL CHEMISTRY LAB
215A	GENERAL CHEMISTRY LAB
215B	IT
216	WIP FILES / VOA OFFICE
216B	VOA PREP
217	SAMPLE STORAGE
218	VOA
219	SVO-GCMS INSTRUMENT LAB
220A	SVO-GCMS OFFICE
220B	SVO-GCMS PREP LAB
221	SAMPLE CONTROL OFFICS
222	PURCHASING
223	RECEIVING
301	MAIN OFFICE AREA
302	TRAINING ROOM
303	CONFERENCE ROOM
304	SOIL PREP
305	SAMPLE MANAGEMENT OFFICE
306	MICROBIOLOGY
306B	MICROBIOLOGY
307	OLC INSTRUMENTS
308	OLC PREP LAB
309	ORGANIC EXTRACTIONS LAB
310	Maintenance/ COM room
311	ELECTRICAL ROOM
312	FIRE ROOM
313	DISHWASHING
314	METALS LOW LEVEL PREP LAB
315	METALS DIGESTIONS
316	TISSUE PREP LAB
317	BOILER ROOM
500	MAINTENANCE ROOM



Appendix E
Analytical and Support Equipment

GENERAL CHEMISTRY/WATER CHEMISTRY LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balances (10): Sartorius, Mettler, Ohaus, Fisher scientific	 1990-2011	 LM	 13
Autoclave - Market Forge Sterilmatic	1988	LM	5
Autoclave – Tutnauer	2010	LM	3
Autotitrator – Thermo Orion 500	2007	LM	3
Calorimeters (2): Parr 1241 EA Adiabatic Parr 6300 Isoparabolic	 1987 2005	 LM LM	 2 2
Centrifuge – Beckman Coulter	2019	LM	13
Colony Counter - Quebec Darkfield	1988	LM	5
Conductivity Meter (1): YSI Model 3200	 2004	 LM	 3
Digestion Systems (4): COD (2) Kjeldahl, Lachat 46-place (1) Skalar Micro Digester, 120 place (1)	 1989 1999 2016	 LM LM LM	 3 2 2
Dissolved Oxygen Meter (2) - YSI Model 5000 & 5100	1988, 1991	LM	4
Distillation apparatus - Easy Still (2), Simple Dist (1)	2000	LM	3
Drying Ovens (6): Shel-Lab and VWR models	 1990-2010	 LM	 13
Flash Point Tester (1): Petroleum Systems Services	 2005	 LM	 2
Flow-Injection Analyzers (2): Bran-Leubbe Lachat 8500	 2002 2007	 LM LM	 3 3
Ion Chromatographs (3) Thermo/Dionex ICS-2000 Thermo/Dionex ICS-1600 Thermo/Dionex ICS-1600	 2006 2009 2015	 LM LM LM	 3 3 3
Meters (ISE and pH) (5) Orion Star A211 Orion Star A214 Orion Dual Star VWR Symphony (2)	 2019 2016 2016 2004, 2013	 LM LM LM	 3 13 13
Microscope - Olympus	1988	LM	1
Muffle Furnace- Sybron Thermolyne Model F-A1730	1991	LM	13
Total Organic Carbon (TOC) Analyzers (4)			

Coulemetrics Model 5012 Teledyne Tekmar Fusion 1 Analytik Jena 2500	1997 2009 2013	LM LM LM	3 2 3
Total Organic Halogen (TOX) Analyzers (3): Mitsubishi TOX-100 (2) Mitsubishi AOX-200	2001 2015	LM LM	3 3
Turbidimeter - Hach Model 2100N	1996	LM	5
UV-Visible Spectrophotometers (1): Perkin Elmer Lambda 25	2008	LM	6
Vacuum Pumps (3): Welch Duo-Seal Model 1376 Busch R-5 Series Single Stage Chem Star 1402N-01	1990 1991 2011	LM LM LM	13 13 13
Water Baths/Incubators (9): Various Fisher Scientific and VWR Models	1986 - 2009	LM	13
Drill Press – Craftsman	2012	-	4
SOIL PREP			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance (12) Mettler AE200 Sartorius Quintix, Practum	1999-2015 2016-2019	MM MM	5 5
Shatter Box (2): GP 1000 SPEX 8530	1989 2011	LM LM	5 5
Sieve Shakers (1): WS Tyler - RX 86	1991	LM	5
Thomas-Wiley Laboratory Mill, Model 4	1989	LM	5
Milkshaker (1) Hamilton Beach	2010	LM	4
Blender (1) Warin Laboratory	2013	LM	5
METALS LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance (9) Mettler AE 200 analytical balance Various Mettler, Sartorius, and Ohaus models	1988-2018	MM	12
Atomic Absorption Spectrophotometers (3): CETAC Mercury Analyzer M-6100 Buck AA Spectrophotometer Model 205 (2)	2010 2008/2015	LM LM	3 3
Atomic Fluorescence Spectrophotometer (2) Brooks-Rand Model III	2005	LM	3

Brooks-Rand Merx	2014	LM	3
Centrifuge - IEC Model Clinical Centrifuge	1990	LM	12
Drying Oven - VWR Model 1370F	1990	LM	12
Freeze Dryers (1) - Labconco	2010	LM	5
Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) (2) Thermo Scientific Model iCAP 6500 Thermo Scientific Model iCAP 6500	 2007 2012	 MM MM	 3 3
Inductively Coupled Plasma Mass Spectrometers (ICP-MS) (4): Agilent 7700 Agilent 7800 Nexion Model 300D	 2014 2016 2011	 MM MM MM	 2 2 2
Muffle Furnace (2) - Thermolyne Furnatrol - 53600	1991, 2005	LM	5
Shaker - Burrell Wrist Action Model 75	1990	LM	12
TCLP Extractors (3)	1989, 2002	LM	5
SEMIVOLATILE ORGANICS SAMPLE PREPARATION LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance (3) Mettler PM480, AG204, AE240 Ohaus Explorer Pro	 1999 - 2015 2016	 MM MM	 12 12
Centrifuge – Beckman Coulter Avanti J-15R	2019	LM	7
Drying Ovens (2) Fisher Model 655G VWR Model 1305U	 1991 1999	 LM LM	 8 8
Evaporators/concentrators Organomation N-Evap (7) Organomation S-Evap (10) Biotage Turbovap (2)	 1990-2010 1990-2010 2013 - 2016	 LM LM LM	 6 7 6
Extractor Heaters: Lab-Line Multi-Unit for Soxhlet and Continuous Liquid-Liquid Extractions (78)	1987-2007	LM	7
Solids Extractors: Sonic Bath VWR Sonic Horn (4) Soxtherm Gerhardt (4) OI Analytical (5)	 1994 1994 2000 2008	 LM LM LM LM	 5 4 3 3
Extractors, TCLP (8): Millipore TCLP Zero Headspace Extractors (10) TCLP 12 position Extractor/Tumbler (2)	 1992-2011 1989-2011	 LM LM	 4 4

Gel Permeation Chromatography (GPC) (4) J2 Scientific AccuPrep (3) Gilson (1)	 2005, 2010 2013	 LM LM	 4 4
Muffle Furnace (2)	2006, 2009	LM	2
Solid Phase Extractors (8) – Horizon SPE-Dex 4790	2003-2008	LM	3
Microwave Extractor – Mars 6 (2)	2014, 2019	LM	4
Edmund Buhler 3-Storey top frame VKS 'Shaker table' (1)	2016	LM	5
GC SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Gas Chromatographs (16): Agilent 6890 GC with Agilent 7683 Autosampler and Dual ECD Detectors (6) Agilent 6890 GC with Agilent 7683 Autosampler and Dual FPD Detectors (1) Agilent 7890A Dual ECD Detectors Agilent 7683B autosampler (4) Hewlett-Packard 5890 GC with HP 7673 Autosampler and FID Detector (1) Agilent 6890 with Dual FID Detectors and Agilent 7873 Autosampler (4) Agilent 7890A Dual NPD Detectors and Agilent 7683B autosampler (1)	 2001, 2005, 2007, 2011 2003 2010 - 2014 1995 2001, 2005 2012	 LM LM LM LM LM LM	 5 4 5 4 4 1
GC/MS SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler AB 104-S	2000	MM	6
Semivolatile GC/MS Systems (10): Agilent 6890/5973 with ATAS Optic2 LVI and HP 7673 Autosampler (2) Agilent 5890/5970 with HP 7673 Autosampler Agilent 5890/5972 with ATAS Optic2 LVI and HP 7673 Autosampler (1) Agilent 6890/5973 with ATAS Optic3 LVI and HP 7683 Autosampler (1) Agilent 6890/5973 with Agilent PTV Injector and 7683 Autosampler (1) Agilent7890A/5975C with Agilent 7693 Autosampler (4)	 1997, 2001 1990 1994 2005 2007 2010 - 2011	 LM LM LM LM LM LM	 5 5 5 5 5 5
Semivolatile GC/MS/MS (2): Waters Quattro Micro GC Micromass with Agilent 6890, Agilent PTV Injector, 7683B	 2008	 MM	 2

Autosampler Agilent 7010B Triple Quad with Agilent 7890B, Agilent PTV Injector, 7693 Autosampler	2018	MM	2
HPLC LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance – (2) Mettler AT250 Mettler AB104-S		 MM MM	 8 8
Drying Oven – Binder ED53		LM	8
Evaporator – Bitage Turbo Vap LV	2016	LM	8
Centrifuge (2) Beckman Coulter Allegra 6 Eppendorf 5415C		 LM LM	 8 8
Ultrasonic Bath (2) VWR Symphony 5.7 L VWR Symphony 20.8 L		 LM LM	 8 8
High-Performance Liquid Chromatographs (3): Agilent 1260 Infinity with Diode Array UV Detector	 2011	 LM	 4
High-Performance LC/MS (4) AB Sciex API 5000 LC/MS/MS with 2x Shimadzu LC-20AD HPLC pumps and SIL-20AC autosampler AB Sciex Triple-Quad 5500 and with 2x Shimadzu LC-20AD HPLC pumps and SIL-20AC autosampler Shimadzu LCMS-8050 with 2x LC-30AD UHPLC pumps and SIL-30AC MP autosampler (2)	 2008 2011 2016	 MM MM MM	 4 4 4
VOLATILE ORGANICS LABORATORY			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
Analytical Balance - Mettler PE 160	1989	MM	5
Fisher Vortex Mixer	1989	LM	5
Drying Ovens (1): Boekel 107801	 1989	 LM	 5
Sonic Water Bath - Branson Model 2200	1989	LM	5
Volatile GC/MS Systems (8): Agilent 5890/5970 Tekmar 3000 Purge and Trap Concentrator Dynatech ARCHON 5100 Autosampler Agilent 6890/5973 Tekmar 3100 Purge and Trap Concentrator Encon Centurion Autosampler Agilent 6890/5973	 1989 1995 1996 2001 2001 2001 2005	 LM LM LM LM LM LM LM	 5 5 5

Tekmar Velocity Purge and Trap Concentrator	2005	LM	
Tekmar Aquatech Autosampler	2005	LM	
Agilent 7980A/5975C (2)	2010, 2011	LM	5
Teledyne Tekmar-Atomx	2010, 2011	LM	
Agilent 6890/5973	2013	LM	5
Encon Evolution Purge and Trap Concentrator	2013	LM	
Encon Centurion Autosampler	2013	LM	
Agilent 7890/5977A	2014	LM	5
Encon Evolution Purge and Trap Concentrator	2014	LM	
Encon Centurion Autosampler	2014	LM	
Agilent 7890B/5977B	2016	LM	5
Teledyne Tekmar Atomx	2016	LM	
Agilent 7890 GC with FID Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler	2013	LM	3
Agilent 7890 GC with FID Encon Evolution Purge and Trap Concentrator Encon Centurion Autosampler	2013 2016	LM	3
AUTOMATED DATA PROCESSING EQUIPMENT			
Equipment Description	**Year Acquired**	**Manufacturer or Laboratory Maintained (MM/LM)**	**# of Trained Operators**
1 - WAN: LIMS Sample Manager using Oracle 11gR2 Enterprise RDBMS running on Red Hat Enterprise Linux Advanced Server v.6.6 platform connected via DMVPN circuits (100 Mbps)	2013	LM	NA
1 - Network Server for reporting and data acquisition running Windows Server 2008 R2 with a 1.4 TB capacity, 1 - Application server running Windows Server 2008 R2	2012	LM	NA
Approximately 90+ HP (3015, 4000, 4014, 4050, 4200, 4250, 4300), Dell 1720dn, and Lexmark M5155 printers.	2010 - 2015	LM	NA
Approximately 220+ Dell/HP PC workstations running Windows XP/Windows 7 on LAN connected via 100BT/1GigE network	2010 - 2015	LM	NA
Microsoft Office 2013 Professional as the base office application suite for all PC workstations. Some systems using Microsoft Office 2003/2007/2010	1996 - 2014	LM	NA
E-mail via Office365.com with webmail via Outlook Web Access. Microsoft Outlook 2013 is standard email client, with some using Outlook 2010	2011 - 2014	LM	NA
Facsimile Machines - Brother 4750e, Brother 2920, and Brother 1860	2005 - 2008	LM	NA
Copier/Scanners - BizHub 283, BizHub 600, BizHub 601 (2), BizHub 654, BizHUb754e (2), BizHub 951, BizHub 1050.	2005 - 2015	LM	NA

Thru-Put, MARRS, Stealth, Harold, Blackbird, EDDGE, CASLIMS, & LabCoat reporting software systems.	1998 - 2014	LM	NA
Data processing terminals (79) - EnviroQuant, Target, Saturn, MassHunter, Chromeleon, MassLynx, Insight.	1996 - 2016	LM	NA

Appendix F
Sample Preservation, Containers, and Hold Times

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Bacterial Tests				
Coliform, Colilert (SM 9223)	W, DW	P, Bottle or Bag	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Coliform, Fecal and Total (SM 9221, 9222D)	W, S, DW	P,G	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Enterococci (Enterolert)	W	P	Cool, 4°C, 0.008% $Na_2S_2O_3$[d]	8 hours
Inorganic Tests				
Acidity (SM 2310B)	W	P,G	Cool, 4°C	14 days[EPA]
Alkalinity (SM 2320B)	W, DW	P,G	Cool, 4°C	14 days[EPA]
Ammonia (SM 4500 NH_3)	W, DW	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Biochemical Oxygen Demand(SM 5210B)	W	P,G	Cool, 4°C	48 hours
Chemical Oxygen Demand (SM 5220C)	W	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Chloride (EPA 300.0)	W, DW	P,G	Cool, 4°C	28 days
Chloride (EPA 9056)	W, S	P,G	Cool, 4°C	28 days
Chlorine, Total Residual (SM 4500 Cl F)	W, S	P,G	Cool, 4°C	24 hours
Chlorophyll-A (SM 11200H)	W	G Amber	Cool, 4°C	48 hours
Chromium VI (EPA 7196A)	W	P,G	Cool, 4°C	24 hours
Color (SM 2120B)	W, DW	P,G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination (EPA 335.4, 9010, 9012, Kelada-01) (SM 4500 CN E,G)	W, S, DW	P,G	Cool, 4°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid	14 days
Cyanide, Weak Acid Dissociable (SM 4500 CN I)	W, S	P,G	Cool, 4°C, NaOH to pH >12	14 days
Ferrous Iron (ALS SOP)	W, D	G Amber	Cool, 4°C	24 hours
Fluoride (EPA 300.0, 9056, SM 4500 F-C)	W, S	P,G	Cool, 4°C	28 days
Formaldehyde (ASTM D6303)	W	G Amber	Cool, 4°C	48 hours

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Hardness (SM 2340 C)	W, DW	P,G	HNO_3 to pH<2	6 months
Hydrogen Ion (pH) (SM 4500 H^+ B)	W, DW	P,G	Cool, 4ºC	Analyze immediately
Kjeldahl and Organic Nitrogen (ASTM D3590-89)	W	P,G	Cool, 4ºC, H H_2SO_4 to pH<2	28 days
Nitrate (EPA 300.0)	W, DW	P,G	Cool, 4ºC	48 hours
Nitrate (EPA 9056)	W, S	P,G	Cool, 4ºC	48 hours
Nitrate-Nitrite (EPA 353.2)	W, DW	P,G	Cool, 4ºC, H_2SO_4 to pH<2	28 days
Nitrite (EPA 300.0)	W, DW	P,G	Cool, 4ºC	48 hours
Nitrite (EPA 353.2)	W, S	P,G	Cool, 4ºC, H_2SO_4 to pH<2	48 hours
Nitrite (EPA 9056)	W, S	P,G	Cool, 4ºC	48 hours
Nitrocellulose	S	G	Cool, 4ºC	28 days
Oil and Grease, Hexane Extractable Material (EPA 1664)	W	G, Teflon Lined Cap	Cool, 4ºC, H_2SO_4 or HCL to pH<2	28 days
Organic Carbon, Total (9060 & SM 5310 C)	W	P,G	Cool, 4ºC, H_2SO_4 to pH<2	28 days
Organic Carbon, Total (ASTM-D4129)	S	P,G	Cool, 4ºC	28 days
Organic Halogens, Adsorbable (EPA 1650B)	W	G, Teflon Lined Cap	Cool, 4ºC, HNO_3 to pH<2	6 months
Organic Halogens, Total (EPA 9020)	W	G, Teflon Lined Cap	Cool, 4ºC, H_2SO_4 to pH<2, No headspace	28 days
Orthophosphate (SM 4500 P- E)	W, DW	P,G	Cool, 4ºC	48 hours
Oxygen, Dissolved (Probe) (SM 4500 O G)	W, DW	G, Bottle and Top	None Required	24 hours
Oxygen, Dissolved (Winkler)	W, DW	G, Bottle and Top	Fix on Site and Store in Dark	8 hours
Phenolics, Total (EPA 420.1, 9056)	W, S	G Amber	Cool, 4ºC, H_2SO_4 to pH<4	28 days
Phosphorus, Total (EPA 365.3)	W	P,G	Cool, 4ºC, H_2SO_4 to pH<2	28 days
Residue, Filterable (TDS) (SM 2540 C)	W	P,G	Cool, 4ºC	7 days
Residue, Nonfilterable (TSS) (SM 2540 D)	W	P,G	Cool, 4ºC	7 days
Residue, Settleable (SM 2540 F)	W	P,G	Cool, 4ºC	48 hours

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Residue, Total (SM 2540 B)	W	P,G	Cool, 4ºC	7 days
Residue, Volatile (EPA 160.4)	W	P,G	Cool, 4ºC	7 days
Silica (SM 4500 SiO_2 C)	W	P Only	Cool, 4ºC	28 days
Specific Conductance (SM 2510 B)	W, DW	P,G	Cool, 4ºC	28 days
Sulfate (EPA 300.0)	W, DW	P,G	Cool, 4ºC	28 days
Sulfate (EPA 9056)	W, S	P,G	Cool, 4ºC	28 days
Sulfide (9030/934)	W, S	P,G	Cool, 4ºC, Add Zinc Acetate, plus Sodium Hydroxide to pH>9	7 days
Sulfide (SM 4500 S_2 D)	W	P,G	Cool, 4ºC, Add Zinc Acetate, plus Sodium Hydroxide to pH>9	7 days
Sulfide (SM 4500 S_2 F)	W	P,G	Cool, 4ºC, Add Zinc Acetate, plus Sodium Hydroxide to pH>9	7 days
Sulfite (SM 4500 SO_3 B)	W	P,G	Cool, 4ºC	24 hours
Sulfides, Acid Volatile	S	G	Cool, 4ºC	14 days
Surfactants (MBAS) (SM 5540 C)	W	P,G	Cool, 4ºC	48 hours
Tannin and Lignin (SM 5550 B)	W	P,G	Cool, 4ºC	28 days
Turbidity (EPA 180.1)	W, DW	P,G	Cool, 4ºC	48 hours
Metals				
Arsenic Species 1632	W	G	HCL to pH<2, Cool < 4ºC	28 days
Mercury (1631E)	W	F	Cool, 4ºC, HCl or H_2SO_4 to pH<2	90 days
Mercury (1631E)	S	F	Freeze < -15ºC	1 year
Mercury (7471)	S	P,G	Cool, 4ºC	28 days
Mercury (EPA 245.1, 7470, 7471)	W, DW	P,G	HNO_3 to pH<2	28 days
Metals (200.7, 200.8, 6010, 6020)	W, DW	P,G	HNO_3 to pH<2	6 months
Metals (200.7, 200.8, 6010, 6020)	S	G, Teflon Lined cap	Cool, 4ºC	6 months

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Methyl Mercury 1630	W, S, T	F	HCL to pH<2	6 months
Volatile Organics				
Gasoline Range Organics (8015, NWTPH-Gx)	W	G, Teflon-Lined, Septum Cap	Cool, 4ºC, HCl to pH<2, No headspace	14 days
Gasoline Range Organics (8015, NWTPH-Gx)	S	G, Teflon- Lined Cap	Cool, 4ºC, Minimize Headspace	14 days
Purgeable Halocarbons (624, 8260)	W	G, Teflon-Lined, Septum Cap	No Residual Chlorine Present; HCl to pH<2, Cool, 4ºC, No Headspace	14 days
Purgeable Halocarbons (624, 8260)	W	G, Teflon-Lined, Septum Cap	Residual Chlorine Present; 10% $Na_2S_2O_3$, HCl to pH<2, Cool, 4ºC	14 days
Purgeable Halocarbons (8260)	S	G, Teflon- Lined Cap	Cool, 4ºC, Minimize Headspace	14 days
Purgeable Halocarbons (8260)	S	Method 5035	Terracore/Encore device, Freeze at -20˚C Methanol, Cool, 4ºC	48 hr. to prepare from device, 14 days after preparing.
Purgeable Halocarbons (8260)	S	Method 5035	Sodium Bisulfate Cool, 4ºC	48 hr. to prepare, 14 days after preparation
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	W	G, Teflon-Lined Septum Cap, No Headspace	No Residual Chlorine Present: HCl to pH<2, Cool, 4ºC, No Headspace	14 days
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	W	G, Teflon-Lined Septum Cap, No Headspace	Residual Chlorine Present: 10% $Na_2S_2O_3$, HCl to pH<2, Cool, 4ºC	14 days
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	S	G, Teflon- Lined Cap	Cool, 4ºC, Minimize Headspace	14 days
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	S	Method 5035	Encore, Freeze at -20˚C Methanol, Cool, 4ºC	48 hr. to prepare from Encore, 14 days after preparation.
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE 624, 8260)	S	Method 5035	Sodium Bisulfate, Cool, 4ºC	48 hr. to prepare from Encore, 14 days after preparation

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Acrolein, Acrylonitrile, Acetonitrile (624, 8260)	W	G, Teflon - Lined Septum Cap	Adjust pH to 4-5, Cool, 4ºC, No headspace	14 days
2-chloroethyl vinyl ether (8260)	W	G, Teflon - Lined Septum Cap	Cool, 4ºC, Minimize Headspace	7 days
Semivolatile Organics				
Nonylphenols	W	G, Teflon-Lined Cap	H_2SO_4 to pH<2, Cool, 4ºC	28 days until extraction;40 days after extraction
Organotins (ALS SOP)	W, S	G, Teflon-Lined Cap	Cool, 4ºC	7[f] days until extraction;40 days after extraction
Otto Fuel	W, S	G, Teflon-Lined Cap	Cool, 4ºC	7[f] days until extraction;40 days after extraction
Methanol in Process Liquid NCASI 94.03	L	G, Teflon-Lined Cap	Cool, 4ºC	30 days
HAPS – Condensates NCASI 99.01		G, Teflon-Lined Cap	Cool, 4ºC	14/30 days
HAPS – Impinger/Canisters NCASI 99.02			Cool, 4ºC	21 days
Acrylamide by HPLC/MS/MS (ALS SOP LCP-ACRYL)	W, S	G, P	Cool, 4˚C	14 days until extraction; 40 days after extraction
Carbamate Pesticides by HPLC/MS/MS (EPA 8321B)	W, S	Amber G, Teflon-Lined Cap	1.2 mL ChlorAC Buffer Cool, 4˚C	7[f] days until extraction; 40 days after extraction
Per- and Polyfluoroalkyl Substances (PFAS) by HPLC/MS/MS (ALS SOP LCP-PFC)	W, S	HDPE, Polypropylene	Cool, 4ºC	14 days until extraction; 40 days after extraction
PBDE/PBB – ROHS GC/MS	W, S, T	G	Cool, 4ºC	40 days after extraction
Pharmaceuticals & Personal Care Products (PPCP) by HPLC/MS/MS (EPA 1694)	W, S	Amber G, Teflon-Lined Cap	50 mg ascorbic acid if residual chlorine present, Cool, < 6ºC	7 days until extraction; 30 days after extraction

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics) (EPA 8015)	W, S	G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction, 40 days after extraction
Alcohols and Glycols (EPA 8015)	W, S	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Acid Extractable Semivolatile Organics (EPA 625, 8270)	W	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Base/Neutral Extractable Semivolatile Organics (EPA 625, 8270)	W	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Acid Extractable Semivolatile Organics (EPA 8270)	S	G, Teflon-Lined Cap	Cool, 4°C[g]	14 days until extraction; 40 days after extraction
Base/Neutral Extractable Semivolatile Organics (EPA 8270)	S	G, Teflon-Lined Cap	Cool, 4°C[g]	14 days until extraction; 40 days after extraction
Chlorinated Herbicides (EPA 8151)	W, S	G, Teflon-Lined Cap	Cool, 4°C[g]	7[f] days until extraction; 40 days after extraction
Chlorinated Phenolics (EPA 1653)	W	G, Teflon-Lined Cap	H_2SO_4 to pH<2, Cool, 4°C[g]	30 days until extraction; 30 days after extraction
Polynuclear Aromatic Hydrocarbons (EPA 625, 8270)	W, S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark[g]	7[f] days until extraction; 40 days after extraction
Organochlorine Pesticides and PCBs (EPA 608, 8081, 8082, GC/MS/MS)	W, S	G, Teflon-Lined Cap	Cool, 4°C	7[f] days until extraction; 40 days after extraction
Organophosphorus Pesticides (GC/MS/MS)	W, S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark[g]	7[f] days until extraction; 40 days after extraction
Drinking Water Organics				
EDB, DBCP, and TCP (EPA 504.1)	W	G, Teflon-Lined Cap	Cool, 4°C, 3 mg $Na_2S_2O_3$, No Headspace	14 days

DETERMINATION[a]	MATRIX[b]	CONTAINER[c]	PRESERVATION	HOLDING TIME
Purgeable Organics (EPA 524.2)	DW	G, Teflon-Lined, Septum cap	Ascorbic Acid, HCl to pH≤2, Cool, 4°C, No Headspace	14 days
Per- and Polyfluoroalkyl Substances (PFAS) by HPLC/MS/MS (EPA 537 ver1.1)	DW, W	Polypropylene	1,25 g Trizma, Cool, 10°C shipment, 6°C storage	14 days until extraction; 28 days after extraction
Haloacetic Acids (EPA 552.2)	DW	G, Amber, Teflon-Lined Cap	100 mg/L NH_4Cl, Cool, 4°C	14 days until extraction; 7 days after extraction
Toxicity Characteristic Leaching Procedure (TCLP)				
Semivolatile Organics (EPA 1311/8270)	HW	G, Teflon - Lined Cap	Sample: Cool, 4°C, Store in dark[g]	14 days until TCLP extraction
			TCLP extract: Cool, 4°C, Store in dark[g]	7 days until extraction; 40 days after extraction
Organochlorine Pesticides (EPA 1311/8081)	HW	G, Teflon Lined Cap	Sample: Cool, 4°C	14 days until TCLP extraction
			TCLP extract: Cool, 4°C	7 days until extraction; 40 days after extraction
Chlorinated Herbicides (EPA 1311/8151)	HW	G, Teflon Lined Cap	Sample: Cool, 4°C	14 days until TCLP extraction
			TCLP extract: Cool, 4°C	7 days until extraction; 40 days after extraction
Mercury(EPA 1311/7470)	HW	P,G	Sample: Cool, 4°C	28 days until extraction
			TCLP extract: HNO_3 to pH<2	28 days after extraction
Metals, except Mercury (EPA 1311/6010)	HW	P,G	Sample: Cool, 4°C	180 days until extraction;
			TCLP extract: HNO_3 to pH<2	14 days until TCLP extraction
Volatile Organics (EPA 1311/8260)	HW	G, Teflon Lined Cap	Sample: Cool, 4°C, Minimize Headspace	14 days until TCLP extraction
			Extract: Cool 4°C, HCL to pH,2, No Headspace	14 days after extraction

Appendix G
Standard Operating Procedures

SOP NAME	Reference Method	SOP Name	REV #
Data Archiving		ADM-ARCH	8
Internal Auditing		ADM-AUDIT	0
Documenting Laboratory Balance and Check Weight Verification		ADM-BAL	10
Sample Batches		ADM-BATCH	13
Handling Customer Feedback, Complaints and Queries (CCQ).		ADM-CCQ	0
Continuous Quality Imrprovement		ADM-CQI	0
Document Control		ADM-DOC_CTRL	1
Department of Defense Projects Laboratory Practices and Project Management – QSM 5.X	DOD QSM v5.1 & 5.0	ADM-DOD5	4
Laboratory Data Review Process		ADM-DREV	13
Contingency Plan for Laboratory Equipment Failure		ADM-ECP	6.1
Making Entries Onto Analytical Records		ADM-ENTRIES	0
New Instrument Suitability and Validation		ADM-INST	0
Laboratory Management Review		ADM-LABMGMT	1
Use of Accreditation Organization Names, Symbols, and Logos		ADM-LOGO	0
Method Development		ADM-MDEV	0
Performing and Documenting Method Detection Limit Studies and Establishing Limits of Detection and Quantitation		ADM-MDL	0
Manual Integration of Chromatographic Peaks		ADM-MI	4
Management of Change		ADM-MOC	0
Nonconformance and Corrective Action Procedures		ADM-NCAR	1.1
Preventive Action		ADM-PA	0
Project Management		ADM-PCM	16
Procurement and Control of Laboratory Services and Supplies		ADM-PROC	0
Proficiency Testing		ADM-PT	0.1
Records Management		ADM-RCRDS	0.1
Quality of Reagents and Standards		ADM-REAG	0
Data Recall		ADM-RECALL	0
Data Reporting and Report Generation		ADM-RG	10.1
Reagent and Standards Login and Tracking		ADM-RLT	7
Support Equipment Monitoring and Calibration		ADM-SEMC	15
Establishing Standard Operating Procedures		ADM-SOP	2

Qualification of Subcontract Laboratories and Internal Subcontracting Protocol		ADM-SUBCONT	0
Software Quality Assurance and Data Security		ADM-SWQADATA	1.2
Employee Training and Orientation		ADM-TRAIN	5
Trending, Control Charts, and Uncertainty		ADM-TREND	2
Checking Volumetric Labware		ADM-VOLWARE	9
Quality Assurance Manual		ALSKL-QM	28
Coliform, Fecal	SM 9221 E EPA 1680	BIO-9221FC	12
Coliform, Fecal (Membrane Filter Procedure)	SM 9222 D	BIO-9222D	6
Coliform, Total (Membrane Filter Procedure)	SM 9222 B	BIO-9222B	2
Coliform, Total	SM 9221 B	BIO-9221TC	7
Colilert® , Colilert-18®, & Colisure®	SM 9223B Colilert	BIO-9223	12
Enterolert	ASTM D6503-99 Enterolert	BIO-ENT	4
Heterotrophic Plate Count	SM 9215 B	BIO-HPC	10
Microbiology Quality Assurance and Quality Control	SM 9020	BIO-QAQC	19
Sheen Screen/Oil Degrading Microorganisms	SM 9221 C	BIO-SHEEN	4
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	EXT-3510	14
Organic Compounds in Water by Microextraction	EPA 3511	EXT-3511	2
Continuous Liquid-Liquid Extraction	EPA 3520C	EXT-3520	19
Solid Phase Extraction	EPA 3535A	EXT-3535	8
Soxhlet Extraction	EPA 3540C	EXT-3540	13
Automated Soxhlet Extraction	EPA 3541	EXT-3541	13
Microwave Extraction	EPA 3546	EXT-3546	3
Ultrasonic Extraction	EPA 3550B	EXT-3550	15
Waste Dilution Extraction	EPA 3580A	EXT-3580	8
Silica Gel Cleanup	EPA 3630C	EXT-3630	6
Gel Permeation Chromatography	EPA 3640A	EXT-3640A	11
Removal of Sulfur Using Copper	EPA 3660B	EXT-3660	9
Sulfuric Acid Cleanup	EPA 3665A	EXT-3665	8
Carbon Cleanup	Restek #EVAN1197	EXT-CARCU	6
Diazomethane Preparation		EXT-DIAZ	10
FDA Extractives		EXT-FDAEX	4
Florasil Cleanup	EPA 3620C	EXT-FLOR	8
Organic Extractions Glassware Cleaning		EXT-GC	11
Percent Lipids in Tissues	PSEP Bligh & Dyer	EXT-LIPID	7

Extraction Method for Organotins in Sediments, Water, and Tissue		EXT-OSWT	12
Preparation of Reagents and Blank Matrices Used in Semivolatile Organics Analysis		EXT-REAG	6
Addition of Spikes and Surrogates		EXT-SAS	11
Zero Headspace Extraction (EPA Method 1311)	EPA 1311	EXT-ZHE	1
Facility and Laboratory Cleaning		FAC-CLEAN	5
Operation and Maintenance of Laboratory Reagent Water Systems		FAC-WATER	5
Flashpoint Determination - Setaflash	EPA 1020A	GEN-1020	10
Color	SM 2120 B EPA 110.2	GEN-110.2	8
Total Solids	SM 2540 B EPA 160.3	GEN-160.3	16
Solids, Total Volatile and Percent Ash In Soil and Solid Samples	SM 2540 E EPA 160.4	GEN-160.4	9
Settleable Solids	SM 2540 F EPA 160.5	GEN-160.5	7
Halides, Adsorbable Organic (AOX)	EPA 1650C	GEN-1650	8
Gravimetric Determination of Hexane Extractable Material (1664)	EPA 1664A/9071B	GEN-1664	13
Alkalinity, Total	SM 2320 B	GEN-2320	12
Hardness, Total	SM 2340 C	GEN-2340	12
Chloride (Titrimetric, Mercuric Nitrate)	SM 4500-CL- C EPA 325.3	GEN-325.3	7
Chlorine, Total/Free Residual	SM 4500-Cl F EPA 330.4	GEN-330.4	4
Total Residual Chlorine - Method 330.5	SM 4500-Cl G EPA 330.5	GEN-330.5	3
Ammonia by Flow Injection Analysis	SM 4500-NH3 G EPA 350.1	GEN-350.1	14
Nitrate/Nitrite, Nitrite by Flow Injection Analysis	EPA 353.2	GEN-353.2	12
Phosphorous Determination Using Colorimetric Procedure	EPA 365.3	GEN-365.3	15
Phenolics, Total	EPA 420.1/9065	GEN-420.1	16
Ammonia as Nitrogen by Ion Specific Electrode	SM 4500-NH3 E	GEN-4500 NH3 E	8
Orthophosphate Determination Using Colorimetric Procedure	SM 4500-P E	GEN-4500 P-E	4
Dissolved Silica	SM 4500-SiO2 C	GEN-4500 SIO2C	6
Sulfide, Methylene Blue	SM 4500-S2- D	GEN-4500S2D	6
Sulfide, Titrimetric (Iodine)	SM 4500-S2- F EPA 9034	GEN-4500S2F	5
Halogens, Total as Chloride by Bomb Digestion	SM 4500-Cl C EPA 5050	GEN-5050	4
Biochemical Oxygen Demand	SM 5210 B, 4500-O G EPA 360.1	GEN-5210B	7

Determination of Methylene Blue Active Substances (MBAS)	SM 5540 C	GEN-5540C	9
Tannin and Lignin	SM 5550 B	GEN-5550	8
Halides, Total Organic (TOX)	EPA 9020B	GEN-9020	11
Total Sulfides by Methylene Blue Determination	SM 4500-S2 D EPA 9030B	GEN-9030	12
Cation-Exchange of Soils - Ammonium Acetate	EPA 9080	GEN-9080	0
Acidity	SM 2310 B EPA 305.2	GEN-ACIDITY	6.1
Total Carbon in Soil	ASTM 4129-05 Lloyd Kahn/PSEP 9060A	GEN-ASTM	14
Sulfides, Acid Volatile	EPA 1629	GEN-AVS	10
Heat of Combustion	ASTM D240-87 ASTM D5865-04	GEN-BTU	5
Chlorophyll-a by Colorimetry	SM 10200 H	GEN-CHLOR	4
Total Cyanides and Cyanides Amenable to Chlorination	SM 4500-CN E, G EPA 335.4, 9012B/9013, Kelada-01	GEN-CN	22
Cyanide, Weak Acid Dissociable	SM 4500-CN- I	GEN-CNWAD	3
Chemical Oxygen Demand	SM 5220 C	GEN-COD	10.1
Conductivity and Salinity in Water and Wastes	SM 2510 B EPA 120.1,9050A Salinity, SM 2520 B	GEN-COND	12
Hexavalent Chromium - Colorimetric	EPA 7196A, 3060A SM 3500-Cr B	GEN-CR6	16
Standard Test Methods for Determining Sediment Concentration in Water Samples	ASTM 3977-97	GEN-D3977	3
Carbonate (CO3) by Evolution and Coulometric Titration	ASTM D513-82M	GEN-D513M	3
Sulfide, Soluble Determination of Soluble Sulfide in Sediment	EPA 376.2	GEN-DIS.S2	3
Bulk Density of Solid Waste Fractions	ASTM E1109-86	GEN-E1109	2
Free Cyanide in Water, Wastewater, and Soil by Microdiffusion	ASTM D4282-83 EPA METHOD 9016	GEN-FCN	0
Ferrous Iron in Water	Lovely/Phillips	GEN-FeII	6
Fluoride by Ion Selective Electrode	SM 4500-F C	GEN-FISE	10
Formaldehyde Colorimetric Procedure	ASTM D6303-98 NCASI 99.02/98.01	GEN-FORM	3
Hydrazine in Water Using Colorimetric Procedure	ASTM D1385-88	GEN-HYD	3
Total Sulfur for Ion Chromatography	EPA 300.0	GEN-ICS	3
Ion Chromatography	EPA 300.0, 9056A	GEN-IONC	21
Color, NCASI	NCASI Bull. #253	GEN-NCASI	5
Oxygen Consumption Rate	SM 2710 B	GEN-O2RATE	2
Carbon, Total Organic Determination (Walkely Black Method)	Walkley Black	GEN-OSU	4
pH in Soil and Solids	EPA 9045D	GEN-pHS	17

pH in Water	SM 4500-H+ B EPA 9040C EPA 150.1	GEN-pHW	17
Sulfides, Reactive	EPA 9030A	GEN-RS	5
Total Sulfide by PSEP	PSEP TC-3991-04	GEN-S2PS	2
Sulfite	SM 4500-SO32- EPA 377.1	GEN-SO3	3
Specific Gravity	SM 2710 F ASTM D854-83	GEN-SPGRAV	2
Solids, Total Dissolved (TDS)	SM 2540 C	GEN-TDS	15
Thiocyanate	SM 4500-CN- M	GEN-THIOCN	4
Nitrogen, Total and Soluble Kjeldahl		GEN-TKN	16
Total Nitrogen and Total Phosphorous by Alkaline Persulfate Digestion NCASI Method TNTP-W10900	NCASI TNTP-W10900	GEN-TNTP	2
Total Organic Carbon in Water	SM 5310 C EPA 9060A	GEN-TOC	15
Solids, Total Suspended (TSS)	SM 2540 D	GEN-TSS	14
Turbidity Measurement	SM 2130 B EPA 180.1	GEN-TURB	9
Labware Washing for Inorganic Analyses		GEN-WASH	6.1
Pharmaceuticals, Personal Care Products, and Endocrine Disrupting Compounds by HPLC/Tandem Mass Spectrometry (HPLC/MS/MS)	EPA 1694	LCP-1694	6
Determination of Selected Per- and Polyfluoroalkyl Substances in Drinking Water by Isotope Dilution Anion Exchange Solid Phase Extraction & Liquid Chromatography / Tandem Mass Spectrometry (LC/MS/MS)	EPA METHOD 533	LCP-533	0
Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)\	EPA 537	LCP-537	7
Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction & Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)	EPA 537.1	LCP-537.1	0
Quantitative Determination of Carbamate Pesticides in Solid Matrices by High Performance Liquid Chromatography/Tandem Mass Spectrometry (HPLC/MS/MS)	EPA 8321B	LCP-8321S	2
Determination of Carbamates in Water by EPA 8321 Using LC Tandem Mass Spectrometry	EPA 8321B	LCP-8321W	3
Acrylamide by High Performance Liquid Chromatography/tandem mass spectrometry (HPLC/mMS/MS)		LCP-ACRYL	3
Quantitative Determination of N-DPA and DPA in Liquid Matrices by High Performance Liquid Chromatography (HPLC)		LCP-DPA	0
Per- and Polyfluoroalkyl Substances (PFAS) by HPLC MS/MS		LCP-PFC	11
Per- and Polyfluoroalkyl Substances (PFAS) by HPLC MS/MS - NJ Edition		LCP-PFC_NJ	0
Total Oxidative Precursor (TOP) Assay of Poly- and Perfluoroalkyl Substances		LCP-TOP	0
Methyl Mercury in Soil and Sediments by Cold Vapor Atomic Fluorescence Spectrometry	EPA 1630	MET-1630S	5

Methyl Mercury in Tissue by Alcoholic Potassium Hydroxide Digestion, Ethylation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry	EPA 1630	MET-1630T	4
Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry	EPA 1630	MET-1630W	5
Mercury by Oxidation, Purge & Trap, and Cold Vapor Atomic Fluorescence Spectrometry	EPA 1631E	MET-1631	16
Determination of Arsenic Species by Hydride Generation Cryogenic Trapping Gas Chromatography Atomic Absorption Spectrophotometry	EPA 1632A	MET-1632	5
Mercury in Water	EPA 245.1	MET-245.1	18
Metals Digestion	EPA 3010A	MET-3010A	17
Metals Digestion	EPA 3020A	MET-3020A	20
Metals Digestion	EPA 3050B	MET-3050B	18
Closed Vessel Oil Digestion	EPA 3051A	MET-3051M	5.1
Closed Vessel Digestion of Siliceous and Organically Based Matrices	EPA 3052	MET-3052M	6
Determination of Metals & Trace Elements by Inductively Coupled Plasma-MS (Method 6020)	EPA 6020B	MET-6020	19
Mercury in Liquid Waste	EPA 7470A	MET-7470A	20
Mercury in Solid of Semisolid Waste	EPA 7471A/B	MET-7471	21
Bioaccessibility of Metals in Soil and Solid Waste		MET-BIOACC	5
Metals Digestion of Aqueous Samples	CLP ILM04.0 EPA 200 series	MET-DIG	20
Sample Filtration for Metals Analysis		MET-FILT	6
Metals Laboratory Glassware Cleaning		MET-GC	10
Determination of Metals and Trace Elements by ICP/AES	EPA 200.7/6010D	MET-ICP	28
Determination of Metals and Trace Elements by Inductively Coupled Plasma-MS (METHOD 200.8)	EPA 200.8	MET-ICPMS	19
Trace Metals in Water by Preconcentration Using Reductive Precipitation Followed by ICP-MS		MET-RPMS	11
Metals and Semivolatiles SPLP Extractions (EPA Method 1312)	EPA 1312	MET-SPLP	3
Waste Extraction Est (WET) Procedure (STLC) for Nonvolatile and Semivolatile Parameters	CA Title 22	MET-STLC	5
Metals and Semivolatiles TCLP Extraction (EPA Method 1311)	EPA 1311	MET-TCLP	11
Sample Preparation fo Biological Tissues for Metals Analysis by ICP-OES and ICP-MS		MET-TDIG	6
Tissue Sample Preparation		MET-TISP	12
Analysis of Water and Solid Samples for Aliphatic Hydrocarbons	EPA 8015C	PET-ALIPHAT	3
Analysis of Waters, Solids, and Soluble Waste Samples for Semi-Volatile Fuel Hydrocarbons	EPA 8015C NWTPH-Dx AK102/103	PET-SVF	17
Analysis of Water and Solid Samples for Total Petroleum Hydrocarbons	EPA 8015C NWTPH-Dx	PET-TPH	2

Analysis of Solid and Aqueous Samples for State of Wisconsin Diesel Range Organics	WI DNR DRO	PHC-WIDRO	5
Bottle Order Preparation and Shipping		SMO-BORD	18
Sample Disposal		SMO-DISP	15
Foreign Soils Handling Treatment		SMO-FSHT	12
Sample Receiving		SMO-GEN	38
Sample Tracking and Internal Chain of Custody		SMO-SCOC	18.1
Organochlorine Pesticides and PCBs (Method 608)	EPA 608	SOC-608	9
Organochlorine Pesticides and PCBs (Method 608.3)	EPA 608.3	SOC-608.3	0.1
Glycols		SOC-8015	14
Organochlorine Pesticides by Gas Chromatography; Capillary Column Technique	EPA 8081B	SOC-8081	22
PCBs as Aroclors	EPA 8082A	SOC-8082Ar	20
Congener-Specific Determination of PCBs by GC/ECD	EPA 8082A	SOC-8082Co	17
Chlorinated Herbicides	EPA 8151A	SOC-8151	19
Chlorinated Phenols Method 8151 Modified	EPA 8151A	SOC-8151M	13
Methanol in Process Liquids and Stationary Source Emissions	NCASI 94.03	SOC-9403	9
Hazardous Air Pollutants (HAPS) in Pulp and Paper Industry Condensates	NCASI 99.01	SOC-9901	6
Alcohols	EPA 8015C	SOC-ALC	3
Butyltins		SOC-BUTYL	16
Calibration of Instruments for Organic Chromatographic Analyses		SOC-CAL	10
Confirmation Procedure for GC and HPLC Analyses		SOC-CONF	8
Aliquoting of Samples		SOILPREP-ALIQUOT	2
Subsampling and Compositing of Samples		SOILPREP-SUBS	2
Particle Size Determination - ASTM Procedure	ASTM D421-85 ASTM D422-63	SOIL-PSASTM	6
Particle Size Determination	ASTM D422 Plumb/PSEP	SOIL-PSP	11
Total, Fixed, and Volatile Solids in Solid and Semi-Solid Samples	EPA 160.3M, EPA 160.4, SM 2540G Mod, and PSEP	SOIL-SOLIDS	2
1,2-Dibromoethane, 1,2-Dibromo-3-Chloropropane, and 1,2,3-TCP BY GC	EPA 504.1	SVD-504	13
Haloacetic Acids in Drinking Water	EPA 552.2	SVD-552	9.1
Chlorinated Phenolics by In-Situ Acetylation and GC/MS	EPA 1653A	SVM-1653A	11
Semivolatile Organic Compounds by GC/MS	EPA 625	SVM-625	8
Semivolatile Organic Compounds by GC/MS	EPA 625.1	SVM-625.1	0
Semivolatile Organic Compounds by GC/MS - Method 8270D	EPA 8270D	SVM-8270D	7

Semivolatile Organic Compounds by GC/MS - Low Level Procedure	EPA 8270D	SVM-8270L	10
Polynuclear Aromatic Hydrocarbons by Gas Chromatography/Mass Spectrometry SIM	EPA 8270D	SVM-8270P	11
Semivolatile Organic Compounds by GC/MS Selected Ion Monitoring	EPA 8270D	SVM-8270S	9
Anthraquinone in Paperboards by GC/MS Selective Ion Monitoring	NCASI AQ-S108.01, EPA 8270D	SVM-AQ	1
Quantitative Geochemical Biomarkers By GC/MS Selective ION Monitoring		SVM-BIO	3
Diisopropyl Methylphosphonate by GC/MS Selective Ion Monitoring	Cert. Method UK16, SOP 217	SVM-DIMP	0
Nonylphenols Isomers and Nonylphenol Ethoxylates	ASTM D7065-06	SVM-NONYL	6
Organophosphorous Pesticides by Method 8270E	EPA 8270E	SVM-OPPMS2	3
Chlorinated Pesticides by GC/MS/MS		SVM-PESTMS2	7
Polybrominated Diphenyl Ethers (PBDEs) and Polybrominated Biphenyls (PBBs) by GC/MS	EPA 8270	SVM-ROHS	2
Purge and Trap for Aqueous Samples	EPA 5030B	VOC-5030	12
Purge and Trip/Extraction for VOC in Soil and Waste Samples, Closed System	EPA 5035A	VOC-5035	15
Volatile Organic Compounds by GC/MS	EPA 524.2	VOC-524.2	19
Volatile Organic Compounds In Water by GC/MS SIM	CA SRL 524.2M	VOC-524.2SIM	2
Volatile Organic Compounds by GC/MS	EPA 624.1	VOC-624	14
Volatile Organic Compounds by GC/MS	EPA 8260C	VOC-8260	21
Volatile Organic Compounds by GC/MS	EPA 8260D	VOC-8260D	0
Volatile Organic Compounds by GC/MS Selective Ion Monitoring		VOC-8260S	5
VOA Storage Blanks		VOC-BLAN	12
Sample Screening for Volatile Organic Compounds in Soil, Water, and Misc. Matrices		VOC-BVOC	10
Gasoline Range Organics by Gas Chromatography	EPA 8015C NWTPH-Gx AK101	VOC-GRO	13

Appendix H
Data Qualifiers

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

Appendix I

Master List of Controlled Documents

Internal QA Documents	Location
Quality Assurance Manual	Q:\QA Manual\QAM.rXX.DOC
ALS-Kelso Certifications/Accreditations	QA Department and online access
MDL/LOD/LOQ Tracking Spreadsheet	MDL_LIST_Master.xls
Technical Training Summary Database	TrainDat.mdb
Approved Signatories List	QAM App A
Personnel resumes/qualifications	HR Department
Personnel Job Descriptions	HR Department/QA Training Files
ALS – Kelso Data Quality Objectives	Kelso DQO table-QA Maintained.xls
Master Logbook of Laboratory Logbooks	QA Masterlog-001
Standard Operating Procedures and Spreadsheet	1_ Kelso SOP.xls
Proficiency Testing Schedule and Tracking Spreadsheet	PT_Schedule.xls
External Normative Documents	**Location**
USEPA Manual for the Certification of Laboratories Analyzing Drinking Water, 5th Edition, EPA 815-B-97-001 (January 2005)	QA Department and online access
USEPA 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and EPA Method Update Rule 2007, 2012, 2017.	QA Department and online access
USEPA 40 CFR Part 141, National Primary Drinking Water Regulations and EPA Method Update Rule 2007.	QA Department and online access
National Environmental Laboratory Accreditation Program (NELAP), 2009 Quality Standards.	QA Department
Quality Standards. American National Standard General requirements for the competence of testing and calibration laboratories, ANSI/ISO/IEC 17025:2005(E).	QA Department
DoD Quality Systems Manual for Environmental Laboratories, Versions 4.2, 5.0, and 5.1.	QA Department and online access
Analytical Methods (see References section).	Laboratory Departments and Online access

Appendix J
Laboratory Accreditations

The list of accreditations, certifications, licenses, and permits existing at the time of this QA Manual revision is given below, followed by the entire primary NELAP and DOD ELAP accreditations (un-numbered attachments). Current accreditation information is available at any time by contacting the laboratory or viewing the ALS Global website www.alsglobal.com.

Program	Number
National Programs	
ISO:IEC 17025:2017	L18-129
DoD ELAP	L18-128
State Programs	
Alaska DEC CSLAP	17-004
Arizona DHS	AZ0339
Arkansas - DEQ	88-0637
California DHS	2795
Florida DOH	E87412
Hawaii DOH	-
Louisiana DEQ	3016
Maine DHS	WA01276
Minnesota DOH	053-999-457
Nevada DEP	WA35
New Jersey DEP	WA005
New York DoH	12060
North Carolina DWQ	605
Oregon - DOH (primary NELAP)	WA100010
South Carolina DHEC	61002
Texas CEQ	T104704427-16-11
Washington DOE	C544
Wyoming/EPA Region 8	R 8 Drinking Water
	Reciprocal Cert.
Miscellaneous	
Foreign Soil Permit	USDA
Plant Import Permit	USDA

Appendix K
Chain of Custody and Cooler Receipt Forms

ALS Environmental

CHAIN OF CUSTODY

1317 South 13th Ave., Kelso, WA 98626 | 360.577.7222 | 800.695.7222 | 360.636.1068 (fax)

SR# ____ PAGE ____ OF ____ COC# ____

PROJECT NAME
PROJECT NUMBER
PROJECT MANAGER
COMPANY NAME
ADDRESS
CITY/STATE/ZIP
E-MAIL ADDRESS
PHONE # FAX #
SAMPLER'S SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625☐ 8270☐ 8270LL☐ SIM PAH☐	Volatile Organics 624☐ 8260☐ 8021☐ BTEX☐	Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐	Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐	PCBs Aroclors☐ Congeners☐	Pesticides/Herbicides 608☐ 8081☐ 8141☐ 8151☐	Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐	Metals, Total or Dissolved (See List below)	Cyanide☐ Hex-Chrom☐	(circle) pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS, Turb.	(circle) NH3-N, COD, TKN, TOC, DOC, NO2+NO3, T-Phos	TOX 9020☐ AOX 1650☐ 506☐	Alkalinity☐ CO3☐ HCO3☐	Dioxins/Furans 1613☐ 8290☐	Dissolved Gases RSK 175☐ Methane☐ CO2☐ Ethane☐ Ethene☐				REMARKS

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

INVOICE INFORMATION

P.O. # ____
Bill To: ____

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 day
___ Standard (15 working days)
___ Provide FAX Results

____ Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

***INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: ____ (CIRCLE ONE)**

SPECIAL INSTRUCTIONS/COMMENTS:

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
Signature	Date/Time	Signature	Date/Time	Signature	Date/Time	Signature	Date/Time
Printed Name	Firm	Printed Name	Firm	Printed Name	Firm	Printed Name	Firm

PM______

Cooler Receipt and Preservation Form

Client ____ Service Request *K20* ____________________

Received: ________________ Opened: ________________ By: __________ Unloaded: ________________ By: __________

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* ____________________ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? ____________________
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N
4. Was a Temperature Blank present in cooler? NA Y N If yes, notate the temperature in the appropriate column below:
   If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":
5. Were samples received within the method specified temperature ranges? NA Y N
   If no, were they received on ice and same day as collected? If not, notate the cooler # below and notify the PM. NA Y N

If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*

Temp Blank	Sample Temp	IR Gun	Cooler #COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed

6. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* ____________________
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Were samples received in good condition (unbroken) NA Y N
9. Were all sample labels complete (ie, analysis, preservation, etc.)? NA Y N
10. Did all sample labels and tags agree with custody papers? NA Y N
11. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
13. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
14. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, Resolutions:____